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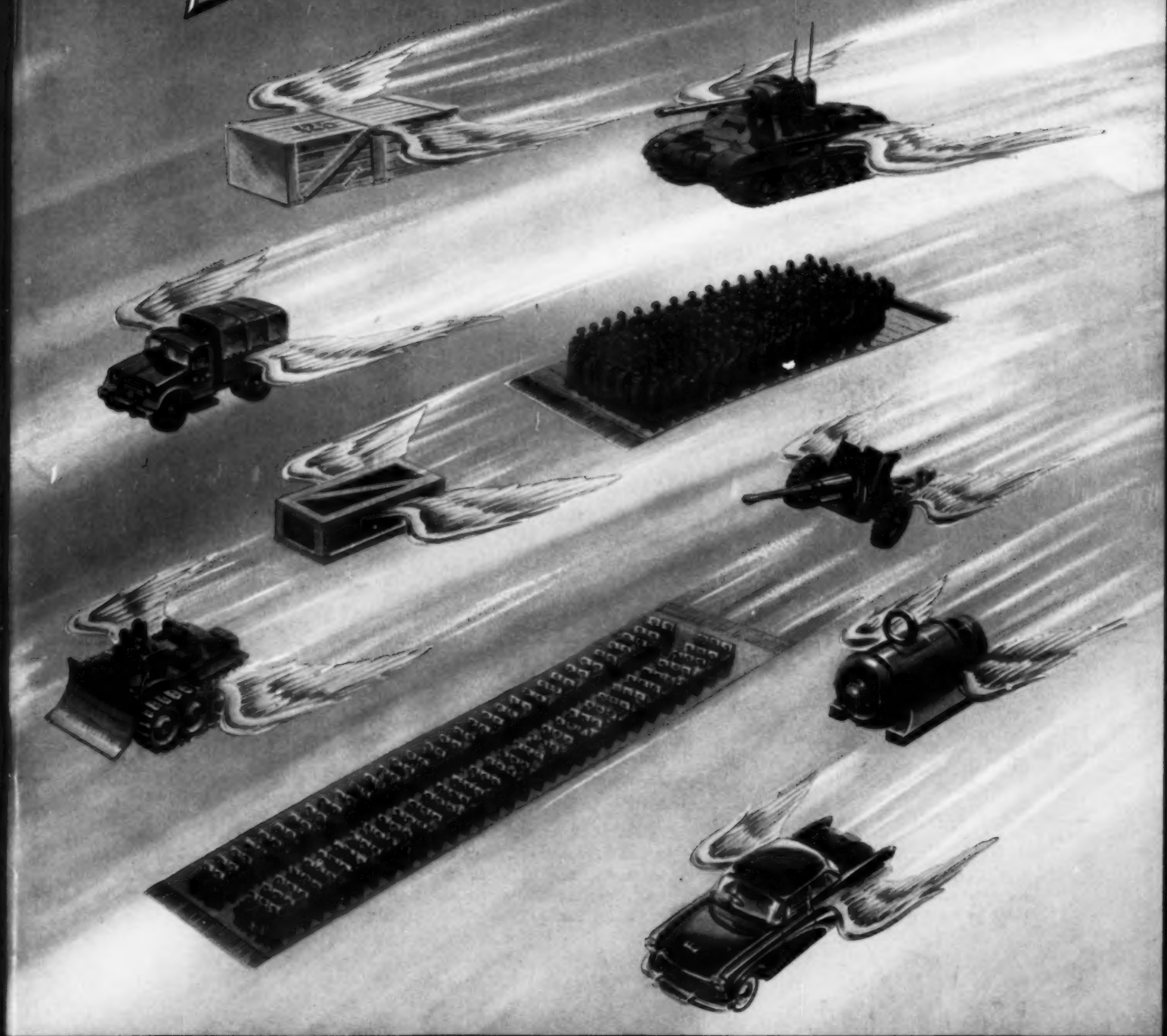

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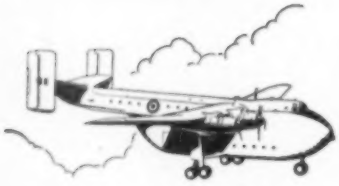
A

Report of the BLACKBURN GROUP of Companies

Extracts from Mr. Eric Turner's review of a record year



The Royal Air Force has three squadrons of "Beverleys" in service and one of these aircraft created a world record by dropping a single load of 29,000 lb. by parachute.

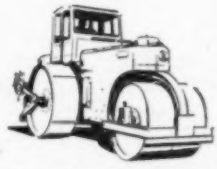
PROFIT AND LOSS ACCOUNT The profit for the year, after all charges other than taxation, of £1,018,491 has passed the million pound mark for the first time, and after providing for tax the nett figure is £514,356, compared with £382,062 last year. The increase in profits was again mainly due to further expansion of Group turnover. These profit figures exclude the sum of £92,745 transferred to capital reserve, being the profit on the sale of certain land at Hanworth, Middlesex. Graph "A" demonstrates the increasing sums which have been retained in the business to finance the growth of our activities. The retained profits are greater than those shown because non-recurring over-provisions of tax amounting to £196,500 and capital profits of almost £100,000 have been excluded.

BALANCE SHEET The total reserves of the parent company and subsidiaries increased by no less than £428,452 and the balances carried forward on profit and loss accounts increased by £35,676, making a total retained in the business of £464,128. During the year we incurred expenditure of some £300,000 on Fixed Assets and at the Balance Sheet date there were outstanding capital commitments of approximately £206,000. In view of likely developments we must be prepared for capital expenditure to increase rather than decrease and I anticipate that next year's accounts will demonstrate this. Since the end of the war the value of the equity has multiplied 2¼ times and I think it quite remarkable that the rate of growth is so consistent. The benefit derived from a broadly-based business is clearly demonstrated, since the demand for our aircraft products was comparatively low during some of these years.

REVIEW OF ACTIVITIES There has been great activity in our design, experimental and works departments on the "N.A.39," the new strike aircraft for the Royal Navy, and the bulk of our production at Brough has again been concerned with "Beverleys" for the Royal Air Force. How much the technical strength of your Company has grown during the past few years may not be generally realised, and you will see from Graph "B" that the numbers of the Parent Company's engineering staffs have multiplied 4¼ times during the last 5¼ years and are still rising. At a time of acute shortage of draughtsmen and engineers this is all the more gratifying and demonstrates not only the growth of the Company but also the ever increasing status and attraction of employment with us. Still more design and laboratory accommodation is being erected for further expansion and good progress is being made with the high speed tunnel and other new development facilities.

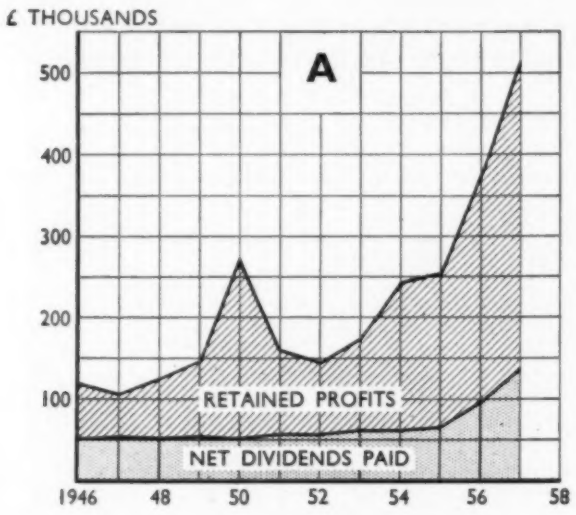
Orders for housing placed with us this year show an increase over last year. It is our intention to participate in the growing market for private housing as soon as sites suitable for development can be obtained.

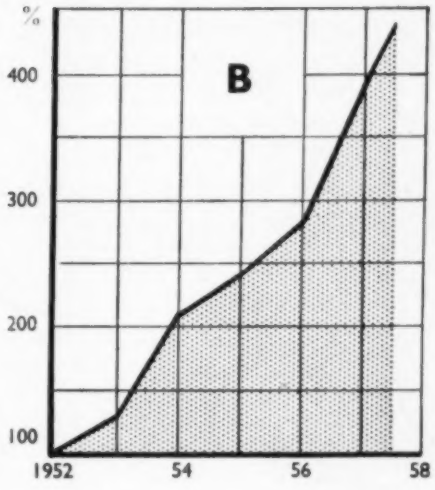
Owing to the weather the Green's Mower Division in common with other manufacturers experienced difficult conditions last year, but I look forward to better results next year.



The Roller Division again did well, especially bearing in mind the low profit margins in export business—a steady expansion in output is planned.

Copies of the Chairman's complete statement will be forwarded on application to the Secretary of the Company at Brough, E. Yorks





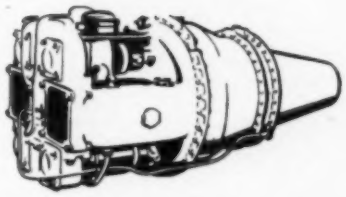
FUTURE OUTLOOK—AIRCRAFT Last year I told you that it seemed likely that the Industry, as well as the Services, would have to face a period of change and re-adjustment, and this prophecy has been amply borne out by the contents of the Defence White Paper.

I cannot help feeling that some manned aircraft will remain in service far longer than is sometimes imagined, even as part of the deterrent and for use in a possible major war. For limited wars, it does not seem conceivable that guided weapons can replace manned aircraft in the foreseeable future.

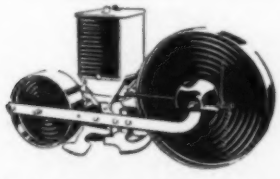
Nevertheless, there will be an overall reduction in the numbers of military aircraft, but as far as your Company is concerned it seems possible that the recent defence changes may increase the demand for our aircraft products rather than lessen it. It is difficult to imagine how a Central Reserve can be effective unless additional orders are placed for aircraft to move the troops and especially their equipment, for which purpose the "Beverley" and its successors seem particularly suitable. We have again put forward to the Service Departments our proposals for the design and manufacture of a version of the "Beverley" powered by four Rolls-Royce "Tyne" engines which could be in service by 1962, by which date conscription will have ended and the need for mobility of the Central Reserve have become imperative.

The 1957-58 Navy Estimates said that "the N.A.39, with its considerable range and ability to carry an atomic bomb, will be a most formidable addition to the striking power of the Royal Navy." We have great hopes that it will become a most successful aircraft, and, moreover, it seems suitable for use with the Royal Air Force, N.A.T.O. and Commonwealth countries as either a land or ship-based bomber. We believe that in its class it will prove to be better than anything else in the world, and it is not without interest that as part of defence aid the United States Government is bearing some of the cost of development of the aircraft and will also provide a large amount of equipment of a type not available in this country to assist rapid and effective flight testing.

It therefore looks as though there are prospects of our having an attractive aircraft programme for a number of years, but we do not intend to neglect any opportunity which presents itself of making a contribution in comparatively new fields such as guided missiles or nuclear power.

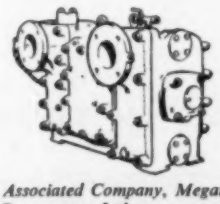


We can look forward to a marked increase in gas turbine business. The "Palouste" is being produced in quantity for various applications—the development of other types has proceeded satisfactorily.



The sales of agricultural equipment expanded during the year and I anticipate a fairly rapid increase in turnover during the next few years.

The acquisition of the Jowett Company has turned out to be a profitable one and despite petrol rationing it has been a satisfactory year for spares and vehicle overhaul.



Our Associated Company, Megator Pumps and Compressors Ltd., once more increased its turnover substantially and seems likely to go on doing so, since the range of pumps has been greatly extended during the year.

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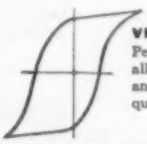

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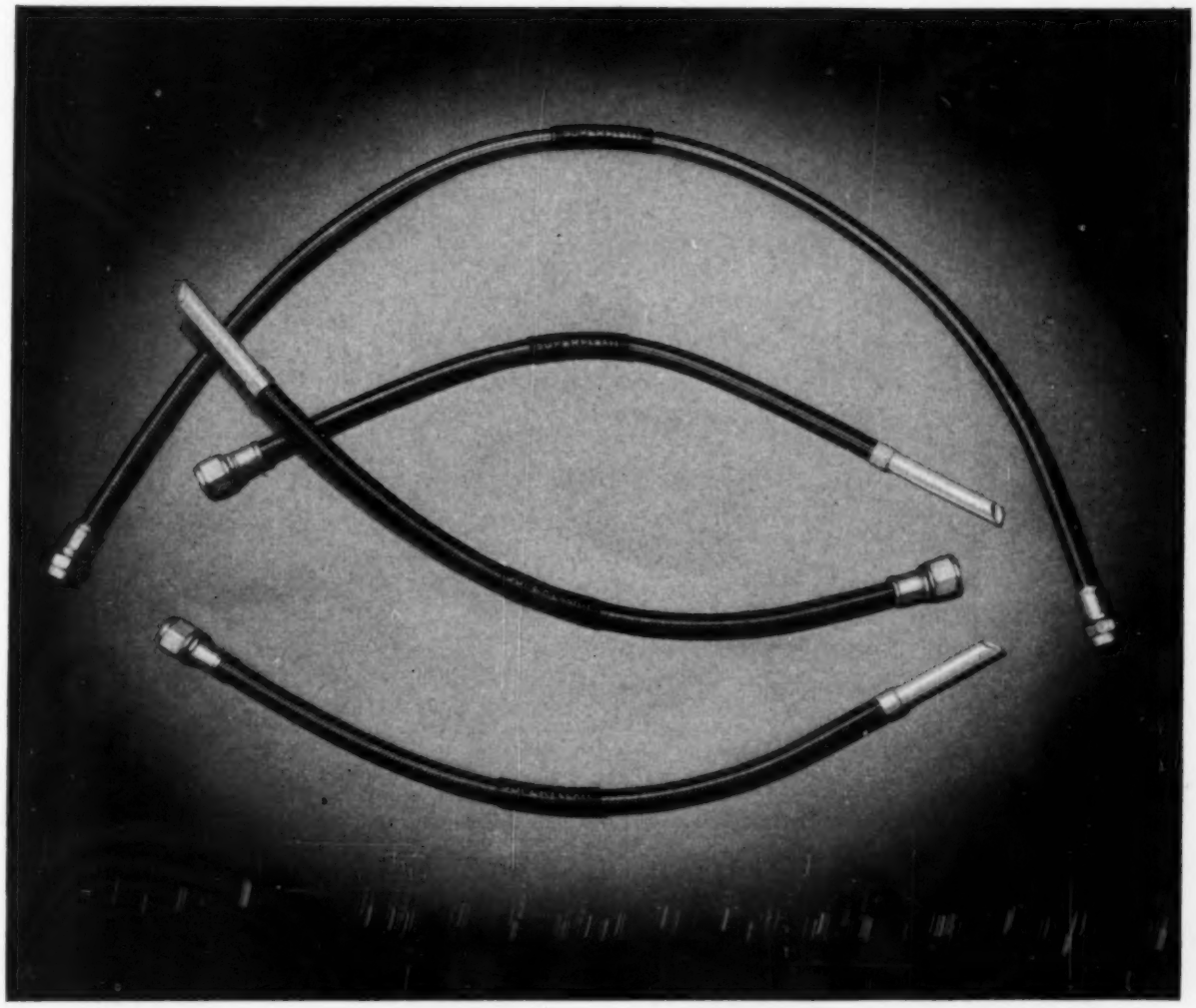

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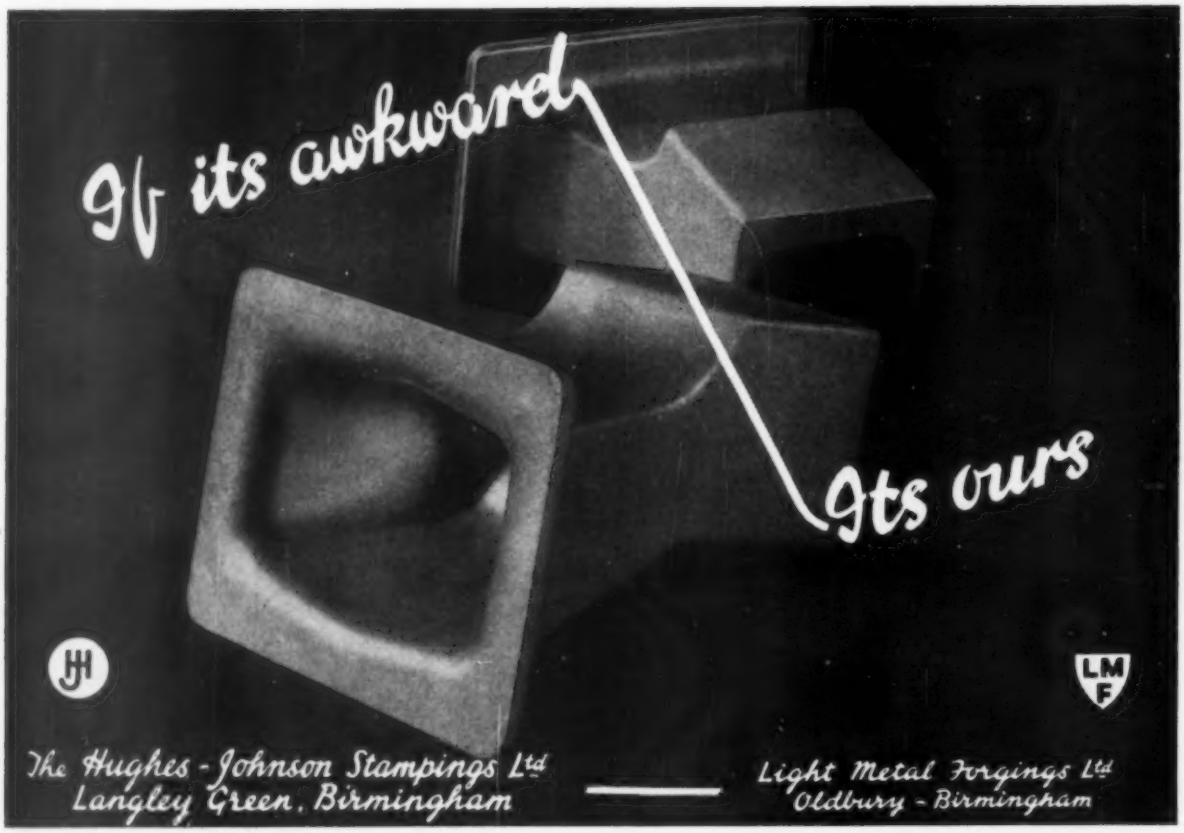

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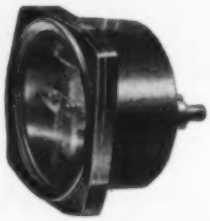

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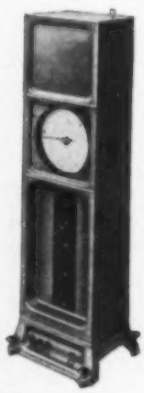

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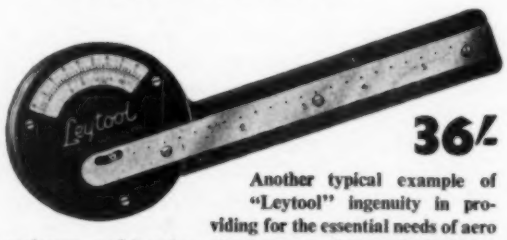

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FLIGHT
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AIRCRAFT ENGINEER

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Back to the "G.P."?

SHADES of the Wapiti, IIIF, Gordon, Hardy and Vincent. Sturdy ghosts of the twenties and thirties. Desert-ranging, frontier-watching, insurgent-suppressing biplanes, girt with gadgets for bombing, strafing, recce., army co-op., rations-carrying, beer-cooling and stretcher-bearing. Guardians of Empire. The butt of the purists and of theorists. Many a kindly laugh they have raised in many a mess since the last of them trundled off to Valhalla.

As in the ways of peace, so in the profession of arms, specialization became *the* thing. And doubtless it was—to a degree; inevitably so as the shadow of a global war blotted out the romantic sunlit scenes of tribal skirmishes.

Yet the old G.P. idea refused to be wholly submerged by the tide of specialization, though its perpetuation was expediency rather than design. Successively came adaptations of intercepters for bombing, rocket-firing, army co-operation and photographic reconnaissance. Then, of course, the Mosquito; concerning which a certain French general—fierce champion of specialization—once confided to us that it was something quite above other aeroplanes, being pre-eminent in each of its multiple rôles!

True, these 1940-45 developments are more precisely labelled "multi-purpose" than "general purpose"; but they did sustain in the Service the idea of versatility—an idea (not a concept, please, lest we offend the weapons-system doctrinaires) which is increasingly abroad now that the prospect of "little wars" is much in mind.

So, while we can hardly look forward to Vincents succeeding Valiants on the Weybridge production line, we can most certainly expect the resurrection of the "G.P." in the form of a sturdy, modern, short-field aeroplane, amenable to the missions of bombing, the attack of ground targets, and reconnaissance. It could, we suppose, be a development of Blackburn's N.A.39; or a form of Hawker's supersonic attack machine. Again, it might be of wholly novel design.

Thus, in a sense, may the Wapiti specification (D.H.9A parts, one Vickers, one Lewis, four 112-pounders, desert rations, spare wheel, kitchen sink) be rewritten under the press of modern circumstances. This time as a wondrous weapons-system doctrine concept—though requiring, as before, a first-class aeroplane for second-class warfare.

Lighter-than-air Speculations

SPECULATION (in the mental sense) is a hobby with no boundaries and a pastime for Everyman. One may speculate whether next weekend will be fine, whether to holiday by the sea or in the country, whether a flight to the moon can be achieved by 2,000 A.D. One can also speculate on what is past; and publication last week of a book on the R.101 tragedy inevitably arouses speculations on what might have happened if its voyage to India and back had been successfully completed. Perhaps regular transatlantic services would have started, following the fine R.34 and R.100 flights; perhaps aeroplane development would have taken a back seat for many years; perhaps mooring-masts would have become as familiar a feature of the countryside as electricity pylons are now.

Certainly there would have been a great deal of aesthetic pleasure in seeing those beautiful silver cigar-shapes move at a leisurely pace over the landscape; and airship travel, with its spaciousness and quiet (we recall Nevil Shute's description in *Slide Rule* of the gramophone playing in the forward promenade deck of the R.100 during its voyage to Canada), offered something unlikely to be paralleled by any future airliner. There might have been a Farnborough Display of airships, deploying their gentle outlines over Laffan's Plain and Cody's tree.

Such, however, is cigar-dreaming; for however far airships might have developed in the 1930s their usefulness would have been shattered by the Second World War. But there is one speculation for the future. It has been suggested recently in our correspondence columns that small lighter-than-air craft could carry heavy loads which now have to make monumental journeys along crowded roads. Airships *can* be put to good use, as the Americans continue to demonstrate. The M.T.C.A., which rules both our roads and air, might well explore such possibilities here.

PARLIAMENTARY PRIVILEGE: Two Members of Parliament—Mr. John Bidgood and Mr. Frank Beswick—recently flew in a Handley Page Victor from Radlett. Photographed during the visit are (l. to r.) Mr. W. R. Burton, a Handley Page test pilot; Mr. Bidgood; F/L. J. W. Allam, H.P. test pilot; G/C. W. L. Houlbrook, H.P. sales department; Mr. Beswick; and Mr. Jock Still, who flew the two fortunate M.P.s.

FROM ALL QUARTERS

Sultan's Appreciation

AFTER attacks by two R.A.F. Shackletons which dropped just over a hundred 20 lb fragmentation bombs—marking a new phase in Central Oman operations—and about 20 sorties by Venoms with rockets and cannon-fire, Nizwa fell to the British and Sultan's forces last Sunday, leaving only one fort (at Jabrin) still in rebel hands.

In a message to A. V-M. L. F. Sinclair, A.O.C. British Forces Arabian Peninsula, the Sultan of Muscat last Saturday expressed his "deep appreciation for the scale and speed of the support provided by the British armed forces" and said he was "particularly grateful for the considerable air-lift and the magnificent offensive action of the R.A.F., both of which have contained rebel activities during the past two weeks."

Carrier-borne Delta

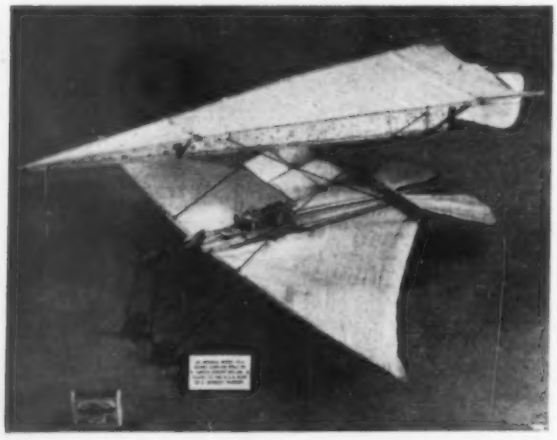
THE report for the year 1955-56 by the Department of Scientific and Industrial Research* refers to the work of the National Physical Laboratory. Mention is made of boundary-layer control research on a thin delta half-wing. This "aims to improve the deck landing and take-off performance of naval aircraft" and may possibly be connected with a naval development of the Saunders-Roe SR.53 mixed-power intercepter. The report goes on to allude to the jet flap, and states that initial work at the laboratory has consisted of wind-tunnel research on the effects of finite wing span and on the usefulness of boundary-layer control at the nose in combination with this important British development.

** Department of Scientific and Industrial Research Report for the Year 1955-56. H.M.S.O., price 9s 6d net.*

New Zealand Canberras

IN Wellington last week the Minister of Defence, Mr. Thomas MacDonald, said that New Zealand would buy a squadron of Canberras from the U.K. for home service and would hire a second squadron from the R.A.F. as a contribution to the strategic air reserve in Malaya. He added that when A.V-M. C. E. Kay visits London for the August 27-28 conference of Commonwealth Chiefs of Air Staff, technical officers accompanying him would make preliminary investigations into "this major change-over in aircraft types."

It is understood that the Canberras to be hired from the R.A.F. would be B.2s, and those for home defence would be B.8s, to be manufactured—together with some T.4s for training purposes—by the English Electric Co. at Preston. New Zealand will thus become the ninth overseas country to adopt the Canberra, over 500 of which have been exported either complete or for manufacture under licence.



SANTOS-DUMONT RELIC: The Brazilian government is to accept from Vickers-Armstrongs (Aircraft), Ltd., a relic of the great Brazilian aviation pioneer Alberto Santos-Dumont. Depicted on the left, this is a model of a design worked out at the turn of the century and was probably one of a series of studies leading to the famous 14-bis in which Santos-Dumont made the first official powered aeroplane flight in Europe—over 220 metres in November 1906.

Harmon Trust Awards

ANNOUNCED in New York last weekend as winners of the 1957 Harmon Trust international aviation awards were Lt-Col. Frank K. Everest (for his pioneer work with rocket aircraft); and Lt-Cdr. Morton L. Lewis and Mr. Malcolm D. Ross for manning a balloon which set up an unofficial altitude record of 76,000ft on November 8 last year.

Conway-Vulcan for Farnborough

IT is learned that Rolls-Royce Conway by-pass turbojets will power an Avro Vulcan which is expected to fly in the S.B.A.C. Display next month. Once again the Rolls-Royce thrust-reverser will be seen in action on a Hunter; and a reverser similar to that intended for the D.H. Comet will be statically shown. The exhibit will demonstrate the action of the mechanism and will be part of a layout featuring an Avon RA.29 and a jet-pipe fitted with a silencer nozzle.

A. V. Roe Canada Expansion?

A BID has been made by A. V. Roe Canada, Ltd., for control of the Dominion Steel and Coal Corporation, one of Canada's leading industrial groups, with assets of over $151m. The offer, if accepted in full, would involve more than $110m (about £39m), including $30m (over £10m) in cash. If the bid is successful, A. V. Roe would become probably the largest industrial holding group in Canada; and it would mean an important additional direct British interest in Canada's economy.

Capt. H. V. Worrall

IT is with regret that we record the death of Capt. Henry Vernon Worrall, who during the war was a production test pilot for A. V. Roe and Co., Ltd., at Yeadon, and until his retirement last year manager of Yeadon Aviation, Ltd. He died in Australia at the age of 69.

Capt. Worrall came to Britain from Tasmania in 1915 to join the R.N.A.S., in which he served with distinction, being awarded the D.S.C. and Bar and the Croix de Guerre. After the war he tested aircraft for the Blackburn Aeroplane Co. at Brough, and with Capt. Norman Blackburn took a machine on a demonstration tour of Brazil in 1927.

He was co-pilot with Sir Alan Cobham on the Singapore I flying-boat survey flight round Africa (1927-28), then test pilot for the Blackburn Aeroplane Co. in Greece. From 1929 until 1939 he was manager and chief instructor of the Yorkshire Aeroplane Club at Yeadon, then from 1939 to 1946 tested Lancasters built there, being appointed M.B.E. for his wartime work.

Battle of Britain "At Homes"

FOR the first time in a Battle of Britain Week, two V-bomber stations will be open to the public on Saturday, September 14, when Gaydon in Warwickshire (the Valiant operational conversion unit) and Honington in Suffolk (a Valiant operational station) will be among 37 R.A.F. stations "at home" in the United Kingdom. Although this is eight fewer than last year, when there was a record attendance of 1,333,000, the Air Ministry expects well over a million visitors.

All the most modern types of R.A.F. aircraft—including the Vulcan and Valiant, Javelin, Comet and Beverley—will give

HARVARD PLUS: This sleek-looking aeroplane is the Erle Bacon Corporation's conversion of the North American T-6 (Harvard). Cruising speed at 64 per cent power is 216 m.p.h.

flying displays and be shown on the ground. Eleven fighter stations will be among those "at home," and Hunters—on which the day intercepter force of Fighter Command is now entirely mounted—are to give aerobatic displays at nearly all the open stations, through an interchange scheme between Commands.

Six stations near large centres of population—Biggin Hill (Kent); Horsham St. Faith (Norwich); Thornaby (Yorks); St. Athan (S. Wales); Castle Bromwich (Birmingham); and Turnhouse (Edinburgh)—have had special flying and static items added to their programmes. Admission to all stations is free; car park proceeds and programme profits (last year amounting to £27,533) will again be shared by the R.A.F. Benevolent Fund and the R.A.F.A. [A full list of stations "at home" is given on p. 233.]

Dutch Agriculturist

HOLLAND's new agricultural aircraft, the high-wing HA-001, made by Holland-Air of Katwijk to the design of J. Velberg, has made a successful first flight at Zestienhoven, near Rotterdam. In the air, says a Dutch correspondent, it is a little reminiscent of the Edgar Percival E.P.9. The cockpit has exceptionally deep windows to give the pilot a good downward view. Spraying equipment has not yet been fitted, but it is the makers' intention to fit faired insecticide-tanks under the wings. The engine is a Lycoming 0-290-D2 of 135 h.p.

Fastest-yet Computer

A NEW electronic digital computer, the Ferranti Mercury, is claimed to be capable of solving problems up to 50 times faster than any other computer made in Western Europe. It is stated that the machine, which is nicknamed "Genius," will be used on large-scale problems connected with guided-missile control and interception, atomic research and nuclear engineering, aircraft design and weather forecasting.

The Ferranti company state that Mercury can do the work of any computer in the world. The first export model is to be shipped to Norway in the next few weeks, and others will be sent to France and Switzerland later this year. Seven Mercury computers have been ordered in this country, and will be used at the universities of London, Oxford and Manchester. One of the machines will also be used at Harwell on problems of reactor design. Price of the computer, including installation and initial maintenance, is about £100,000.

Continental Cadets' Club Visit

TEN cadets from five European countries, one of three such parties who have visited Britain under the auspices of R.A.F. Home Command, recently visited Fair Oaks in order to see a typical flying club at work. It was the first time for ten years that such an item had been included in the itinerary of a visiting cadet party. The European boys—from France, Holland, Denmark, Norway and Sweden, and with ages ranging from 17 to 19—travelled from Uxbridge by R.A.F. coach and were entertained for lunch at the Otter Hotel in nearby Ottershaw.

During the afternoon all the boys flew—in Austers or Tiger Moths or (in the case of one of the French cadets) in *Flight*'s Gemini. By the time of their departure at half-past five all concerned—including Mr. G. H. M. Miles, who as chairman of the A.B.A.C. arranged the visit, and W/C. C. E. F. Arthur, Fair Oaks C.F.I. and Manager—agreed that it had been thoroughly worthwhile and that flying clubs should figure in future cadet itineraries.

"FLIGHT" AND FARNBOROUGH

AGAIN this year *Flight* will publish four greatly enlarged special numbers in connection with the S.B.A.C. Show. Their dates and titles will be:—

August 23: "Commonwealth Aircraft Industries". Appearing next Friday, this issue will offer new facts about the ordinarily unpublicized activities of aircraft, engine and components manufacturers in the countries of the British Commonwealth.

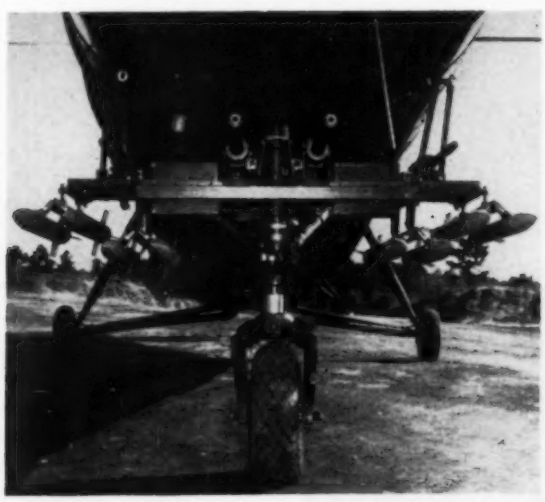
August 30: "Britain's Aircraft Industry". A detailed, specially illustrated review of British aircraft, engines and components, including a quick-reference directory to the aeronautical products and services of several hundred firms.

September 6: "Farnborough Report". A first-hand report on the aircraft and flying demonstrations at the opening of the show, illustrated with *Flight* photographs.

September 13: "Farnborough Review". The rest of the show-week news, together with a further survey of technical innovations, illustrated by *Flight* photographs and drawings. Regular features will appear in this and the other Farnborough numbers.

Demand for these special issues is this year likely to be even heavier than usual, so advance orders to newsagents are strongly advised. The very big August 30 issue will sell at 2s. 6d., the others at the normal price of 1s. 6d.

WAR AND PEACE: Below are two 0.5in and two 0.3in guns and eight 80 mm Oerlikon rockets mounted on a Vertol H-21 of the U.S. Army. On the right is an S-58 (operated by World Wide Air Services, Ltd.) transporting drilling rig and equipment to a new well site of the British Petroleum Company at Sireru, Papua, New Guinea.



FIGHTER FLIGHT INSTRUMENTATION

A Radical New Presentation from Kelvin and Hughes

FOR many years, instrument development has followed a steady pattern of extending the ranges and increasing the accuracy of established basic designs. Panel presentation has remained virtually static. But it has recently become increasingly obvious that for modern high-speed aircraft this state of affairs could not continue much longer; greatly increased performance, sustained steep attitudes and the need for more accuracy and closer integration of aerodynamic and navigational information has caused pilots and manufacturers to consider if a new approach to the problem of cockpit presentation was not possible. One pilot's suggestions for such a system were published in *Flight* for November 23, 1956.

Working in conjunction with the M.o.S., the R.A.E. and the Institute of Aviation Medicine, and with the assistance of a number of other companies, Kelvin and Hughes (Aviation), Ltd., New North Road, Barkingside, Essex, have produced an entirely new display design. Their "flight data system" integrates flight dynamic and aerodynamic information in a comprehensive presentation which aims at giving the pilot accurate and unambiguous information, provided by air data computation.

The layout of the new system can be seen from the photograph. The display units are servo-operated and respond to data received from the separate sensing, detector and computer units of the flight dynamic and aerodynamic reference systems. The flight dynamic system presents on two instruments the information normally supplied by the artificial horizon, directional gyro, gyro magnetic compass, I.L.S., flight director, Tacan range and bearing and side-slip information.

The new instruments are an attitude indicator—which in general takes the place of the artificial horizon and also displays flight-director command information—and a navigation display which has four modes of operation to replace information conventionally supplied by three indicators. These two presentations of flight dynamic reference require seven computer or detection units to show attitude and heading and to supply control signals to an autopilot. An essential component of the system is a master reference gyro (made by S. G. Brown, Ltd., of Watford) designed to feed continuous information through 360 deg of pitch and roll.

Attitude Indicator: This gives the pilot an instantaneous display of pitch and roll relative to the horizon. It consists of a roller blind mounted on a table which rotates in a plane parallel to the face of the instrument. The blind is divided laterally into a white (sky) and a black (earth) section and is driven up and down the dial with changes in pitch and rotated in roll. Straight and level flight is indicated when the colour division lies coincident with a small fixed central circle and when the moving lubber-line is coincident with the vertical reference at the bottom of the dial.

Flight command information is represented by a moving graticule consisting of a ring between the glass and the blind; its position in relation to the central index shows the command direction. The director graticule is centred when the aircraft is on the selected path.

Navigation Display is on the panel next to the attitude indicator. Again, roller-blind presentation is used and various modes are selected for display in the same panel space. A compass card and heading pointer remain visible in each mode. *Mode 1* is a compass display. Heading is shown on the panel and this information can also be fed to other equipment, such as an autopilot or flight director. Magnetic heading information is provided by a remote detector, signals from which are resolved in the navigation display and compared with the position of the gyro reference; these signals are used for the M.R.G. to monitor the azimuth gyro.

Mode 2 is the I.L.S. function. The output of the I.L.S. receiver is fed to the attitude indicator *via* the flight-director computer to display command signals. Displacement scale marks are at the top of the display; beam and glide-slope signal flags appear in windows below.

The navigation display shows Tacan range and bearing as *Mode 3*. The face of the blind in the "TAC" mode shows a continuous line to indicate the bearing to the station and pictorial presentation of the aircraft's relative position. The remaining function, *Mode 4*, is a homing aid used in conjunction with the Tacan offset-computer and the Tacan radar navigation system. This gives a similar display to the previous mode but the range is extended from 200 to 400 n.m.

Aerodynamic Reference System: This is essentially an air data computer, sensing pitot and static-pressures and temperature, to provide airspeed and Mach number information on a speed display, and altitude and vertical speed on a height display.

The pitot and static pressure sensing units consist of two force-balance systems in which the force output from a capsule is balanced against a precision spring; the mechanical output is rotary. This gives a very accurate linear output and reduces the lag effects in the pressure-measuring system. A position-error probe and correction units then rectify the pressure information. Angle of incidence and other correction factors could be added within the circuits of the electro-mechanical correction units.

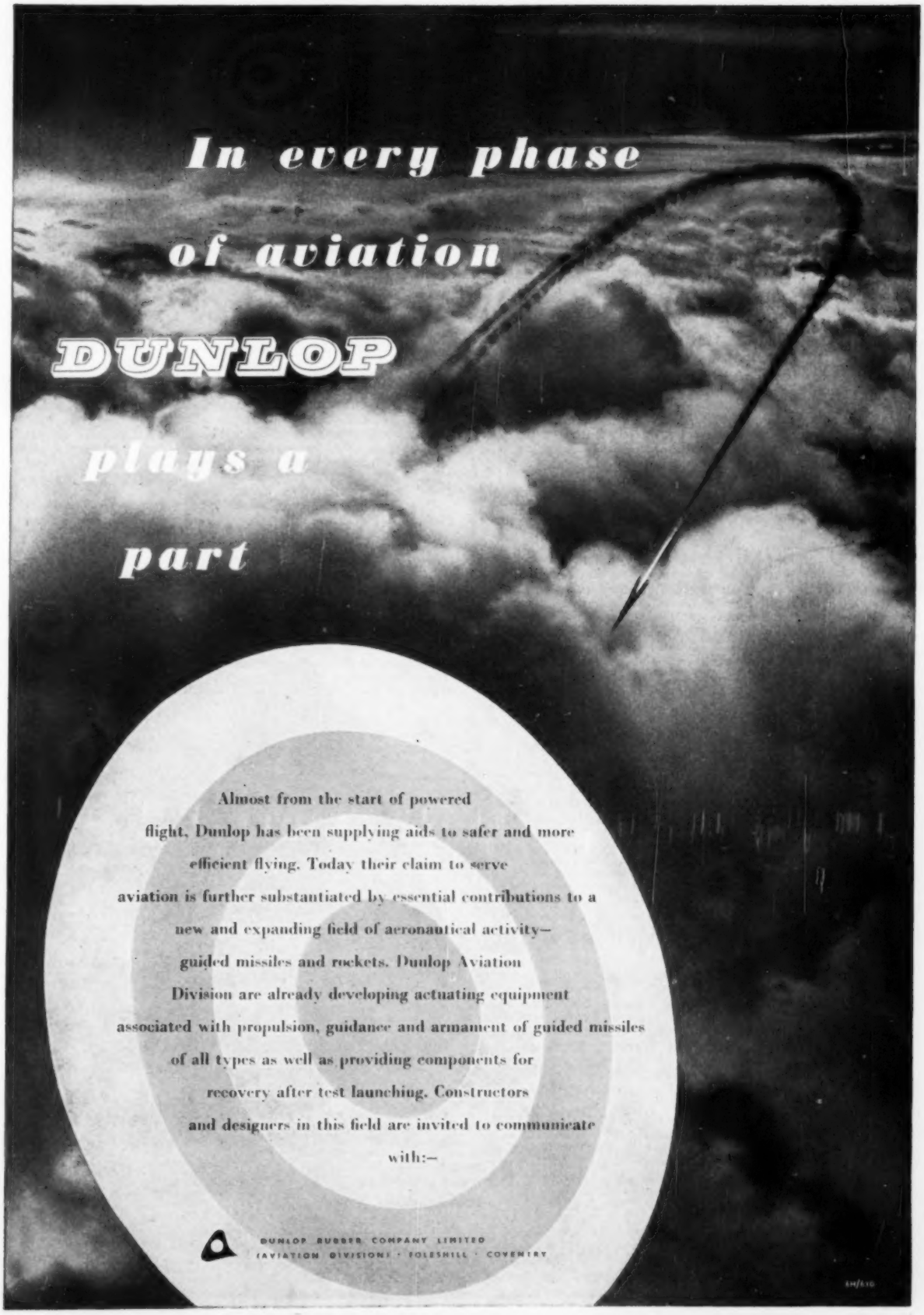
The corrected outputs are fed to a computer which divides $(P-S)$ by S and introduces a correction factor to obtain $(\text{Mach})^2$. This function is typically reduced to pure Mach number by a cam, and is transmitted *via* a synchro to the presentation. Corrected static pressure is also fed to the presentation *via* a synchro unit. An electro-mechanical circuit in the computer applies a static pressure correction depending upon the required millibar setting; this is fed in from a knob and veeder counter unit in the height display presentation. Similarly, corrected static pressure fed to the rate of change computer is displayed as a non-linear vertical speed indication on the altitude presentation. This is shown by a fixed index and a vertical moving tape calibrated to the standard height/pressure relationship. Non-linear scales gives greater accuracy at low altitudes and vertical speeds.

Indicated airspeed and Mach number are also shown together: airspeed on a fixed horizontal scale with a moving pointer and Mach number with the same pointer but on a moving linear scale.

APPROXIMATE DIMENSIONS AND WEIGHTS

Component	Height (in)	Width (in)	Depth (in)	Weight (lb)
Speed display	3	12	10	8
Height display	6	3	10	6
Attitude indicator	6	6	10½	6½
Navigation display	6	6	10½	9
Offset computer	3	3	10	1
Compass amplifier	4½	8½	10½	8
Air data computer	8	10	12	25
Compass detector	4½	4½	4	3

The new Kelvin and Hughes system presents information on four instruments. The top strip gives I.A.S. and Mach number and that on the left shows height (on a logarithmic scale) and rate of climb. At the centre are the attitude and slip indicators and on the right is the navigation panel, set to Mode 1 direct compass display.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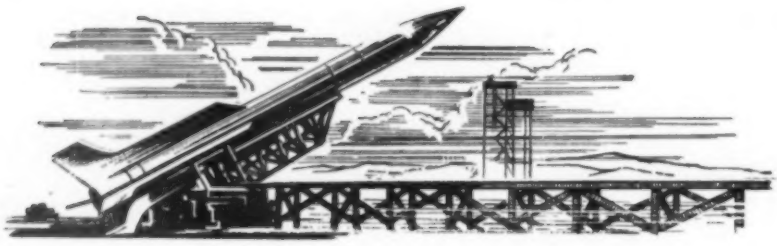

Teddington Potentiometers, Accelerometers and Pressure Transducers, manufactured in Great Britain under licence from Giannini of America, are being developed to meet the requirements of the British Aircraft Industry for applications in missile control and telemetering systems. Standard units can be modified to suit individual specifications for linearity, shaft displacement, resistance and resolution.

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The Fairey Safety Ohmmeter is Recommended by the Ordnance Board and Approved by the Ministry of Supply for the British Army and the Royal Air Force.

Ranges: 0-10 ohms 0-100 ohms 0-1 Kohm 0-10 Kohms

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REFINING TITANIUM

—*at Sheffield: Jessops' Production Methods*

ALTHOUGH the existence of the metal titanium has been known since 1791, and the firm of William Jessop and Sons was founded in 1774, it was not until 1951 that the first laboratory exploration of the metal's possibilities was made at the famous Sheffield steel makers. This date was in fact very soon after the first small batches of titanium were produced in America and the expansion of production to the considerable volume from Jessops today is a story of remarkable technological progress.

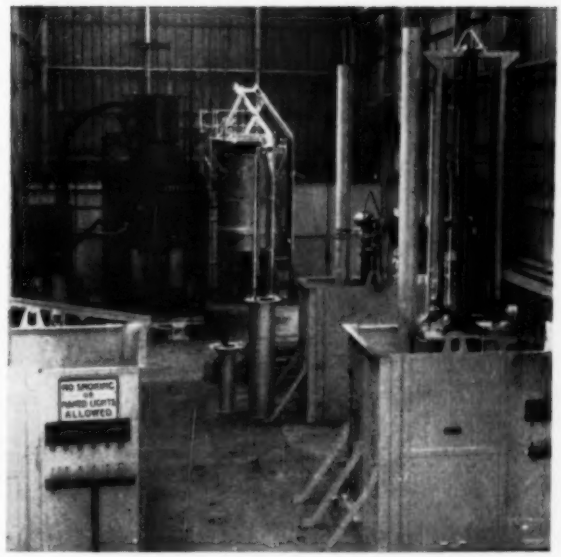
Between 1951 and 1952 the firm evaluated in their laboratory over 200 titanium alloys, as they realized that the exciting properties of the metal (it has a high creep strength and is 60 per cent lighter, volume for volume, than steel) would be exploited in future aero engines—many of the components of which they were already making in steel. It was decided by the Board in 1954 that production of titanium should be on a sufficient scale for the firm to be able to produce the largest components (such as compressor discs) that were likely to be required; particularly as I.C.I. were already starting the manufacture of the smaller sections. Large components required large furnaces and, by buying early designs from America, it was possible to manufacture one-ton ingots—the largest obtainable for the aircraft industry in Europe.

Titanium is an expensive metal, and so is the plant that is required for its manufacture. Jessops, who financed the establishment of their titanium production without government help, spent £300,000 on the installations of their melting department. A very large concentration of effort has gone into the techniques of producing titanium and its alloys (the Jessop range are known as "Hylite") and, inevitably, the discovery of new processes has made much of the earlier equipment out of date. Nevertheless, if an industrial lead is to be maintained, the piper must be paid, and the firm are currently spending £2 million in a four-year development programme to modernize melting plant that has become out of date as techniques have advanced.

A good deal of thought has been given to avoiding any production bottlenecks that are likely to occur; a useful reserve of titanium sponge (more accurately called granules when liberated by the I.C.I. magnesium process) has been accumulated, and the Jessop plant can, at the moment, produce about five tons a week. This is more than the present requirements of the British aircraft industry, which demands, according to some estimates, proportionately less titanium than U.S. aircraft and engine manufacturers. One reason why this should be so is that the price of titanium in the U.K. is still rather higher than across the Atlantic, but it was also noticeable that there was a slump in demand coinciding with the Defence White Paper earlier this year.*

Only limited use is yet made of titanium as an airframe constructional material, and particularly is this the case with forgings: apart from deck-arrester gear hooks, Jessops say, practically no forged titanium components are made for British aircraft, although they are quite extensively used in the United States.

* *An outline of all aspects of I.C.I. titanium production was published in our issue of March 8 last.*



Jessops' titanium melting department. Left and right in the foreground are the first- and second-stage melting furnaces.

Titanium is delivered to Jessops in granule form from I.C.I. It is also obtainable in quite good quality from Japan, but this is not a regular source of supply. Stringent precautions are taken in handling the metal at this stage, as the granules—which are spark-sensitive—cannot be extinguished if they are set alight. The best that can be done is to blanket them from oxygen.

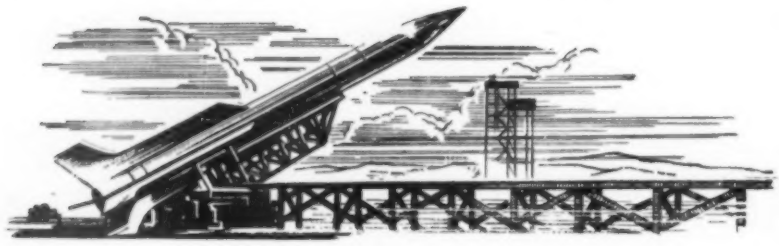
The first stage in manufacture is to mix the various supply batches in a special hopper to ensure that as uniform a supply as possible is fed through the processes which follow. The hopper used consists of an upper and lower cone, the upper one of which is inverted. Mixing takes place as the charge filters through into the lower cone. The light, powdery granules are then placed into a Davy-United hydraulic compacting press where the alloying ingredients are also added in divided form. Aluminium, tin, molybdenum, vanadium, and manganese are the most commonly used alloying elements.

The compacted blocks of titanium granules and alloys are next welded together to form a large, consumable electrode—a skilful process that Jessops have developed to avoid the use of electrodes of contaminating carbon or tungsten. The long electrode is fed into a cylindrical chimney, which is raised—rather like the funnel of a Thames tug—over the vacuum melting furnace that is the heart of the titanium manufacturing process. Anyone hoping to see a spectacular "roaring fiery furnace" as the titanium is melted and cast into ingots would be disappointed; the copper-lined crucible is water-shrouded and electrically heated. Each of the four furnaces requires 20,000 amp D.C. to raise the temperature to 1,700-1,800 deg C, and this current is controlled from a row of remote Westinghouse switchboards.

The crucibles are actually under the shop floor, protruding into a protected well which houses the vacuum motors for evacuating the crucible during the melt. This has been found to be the most satisfactory way of keeping the ingot free from impurities, and it allows the hydrogen to be drawn off during melting. When the ingot is cold, it is released from the slightly tapered crucible (a copper lining is used because of titanium's affinity to any refractory) and loaded into a remelt furnace from which a shorter, stubbier ingot weighing about a ton is removed. This is covered with a coarse skin which has to be turned-off before it can be forged. This process highlights one of the reasons for the high cost of titanium: swarf, turnings and other scrap cannot (except in very small quantities) be melted down and used again. Methods of overcoming this difficulty are being actively investigated.

The skimmed ingot is the raw material which is forged and rolled to produce the Hylite range of titanium products. These vary from bars, drawn tubes, wire, hot rolled sheet (which can readily be welded with titanium rod) to large compressor-disc stampings and forgings in Hylite 50 (a complex aluminium alloy). At 400 deg C this advanced alloy has a creep strength of 39 tons/sq in; the nearest comparable alloy in the U.S., it is claimed, has a creep strength of only 18 tons/sq in.

After the ingot is cooled, the rough surface is machined off. This ingot is of 20in diameter and weighs 2,000 lb.



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REFINING TITANIUM

—at Sheffield: Jessops' Production Methods

ALTHOUGH the existence of the metal titanium has been known since 1791, and the firm of William Jessop and Sons was founded in 1774, it was not until 1951 that the first laboratory exploration of the metal's possibilities was made at the famous Sheffield steel makers. This date was in fact very soon after the first small batches of titanium were produced in America and the expansion of production to the considerable volume from Jessops today is a story of remarkable technological progress.

Between 1951 and 1952 the firm evaluated in their laboratory over 200 titanium alloys, as they realized that the exciting properties of the metal (it has a high creep strength and is 60 per cent lighter, volume for volume, than steel) would be exploited in future aero engines—many of the components of which they were already making in steel. It was decided by the Board in 1954 that production of titanium should be on a sufficient scale for the firm to be able to produce the largest components (such as compressor discs) that were likely to be required; particularly as I.C.I. were already starting the manufacture of the smaller sections. Large components required large furnaces and, by buying early designs from America, it was possible to manufacture one-ton ingots—the largest obtainable for the aircraft industry in Europe.

Titanium is an expensive metal, and so is the plant that is required for its manufacture. Jessops, who financed the establishment of their titanium production without government help, spent £300,000 on the installations of their melting department. A very large concentration of effort has gone into the techniques of producing titanium and its alloys (the Jessop range are known as "Hylite") and, inevitably, the discovery of new processes has made much of the earlier equipment out of date. Nevertheless, if an industrial lead is to be maintained, the piper must be paid, and the firm are currently spending £2 million in a four-year development programme to modernize melting plant that has become out of date as techniques have advanced.

A good deal of thought has been given to avoiding any production bottlenecks that are likely to occur; a useful reserve of titanium sponge (more accurately called granules when liberated by the I.C.I. magnesium process) has been accumulated, and the Jessop plant can, at the moment, produce about five tons a week. This is more than the present requirements of the British aircraft industry, which demands, according to some estimates, proportionately less titanium than U.S. aircraft and engine manufacturers. One reason why this should be so is that the price of titanium in the U.K. is still rather higher than across the Atlantic, but it was also noticeable that there was a slump in demand coinciding with the Defence White Paper earlier this year.*

Only limited use is yet made of titanium as an airframe constructional material, and particularly is this the case with forgings: apart from deck-arrester gear hooks, Jessops say, practically no forged titanium components are made for British aircraft, although they are quite extensively used in the United States.

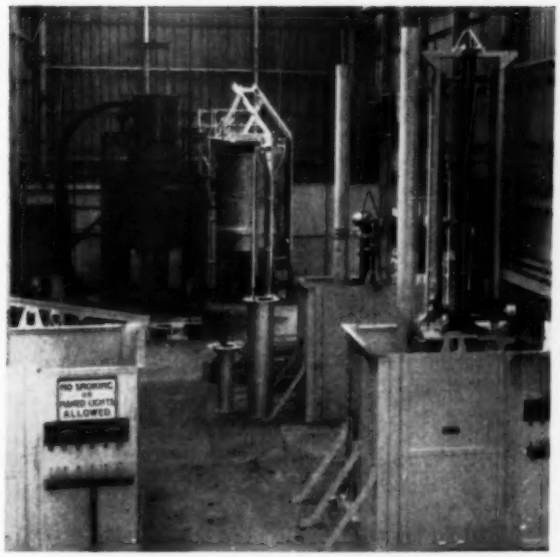
Titanium is delivered to Jessops in granule form from I.C.I. It is also obtainable in quite good quality from Japan, but this is not a regular source of supply. Stringent precautions are taken in handling the metal at this stage, as the granules—which are spark-sensitive—cannot be extinguished if they are set alight. The best that can be done is to blanket them from oxygen.

The first stage in manufacture is to mix the various supply batches in a special hopper to ensure that as uniform a supply as possible is fed through the processes which follow. The hopper used consists of an upper and lower cone, the upper one of which is inverted. Mixing takes place as the charge filters through into the lower cone. The light, powdery granules are then placed into a Davy-United hydraulic compacting press where the alloying ingredients are also added in divided form. Aluminium, tin, molybdenum, vanadium, and manganese are the most commonly used alloying elements.

The compacted blocks of titanium granules and alloys are next welded together to form a large, consumable electrode—a skilful process that Jessops have developed to avoid the use of electrodes of contaminating carbon or tungsten. The long electrode is fed into a cylindrical chimney, which is raised—rather like the funnel of a Thames tug—over the vacuum melting furnace that is the heart of the titanium manufacturing process. Anyone hoping to see a spectacular "roaring fiery furnace" as the titanium is melted and cast into ingots would be disappointed; the copper-lined crucible is water-shrouded and electrically heated. Each of the four furnaces requires 20,000 amp D.C. to raise the temperature to 1,700-1,800 deg C, and this current is controlled from a row of remote Westinghouse switchboards.

The crucibles are actually under the shop floor, protruding into a protected well which houses the vacuum motors for evacuating the crucible during the melt. This has been found to be the most satisfactory way of keeping the ingot free from impurities, and it allows the hydrogen to be drawn off during melting. When the ingot is cold, it is released from the slightly tapered crucible (a copper lining is used because of titanium's affinity to any refractory) and loaded into a remelt furnace from which a shorter, stubbier ingot weighing about a ton is removed. This is covered with a coarse skin which has to be turned-off before it can be forged. This process highlights one of the reasons for the high cost of titanium: swarf, turnings and other scrap cannot (except in very small quantities) be melted down and used again. Methods of overcoming this difficulty are being actively investigated.

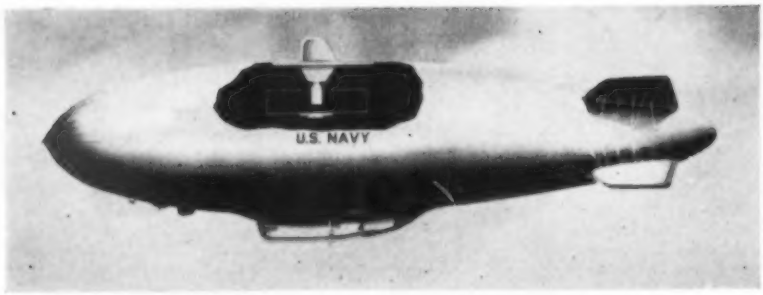
The skimmed ingot is the raw material which is forged and rolled to produce the Hylite range of titanium products. These vary from bars, drawn tubes, wire, hot rolled sheet (which can readily be welded with titanium rod) to large compressor-disc stampings and forgings in Hylite 50 (a complex aluminium alloy). At 400 deg C this advanced alloy has a creep strength of 39 tons/sq in; the nearest comparable alloy in the U.S., it is claimed, has a creep strength of only 18 tons/sq in.



Jessops' titanium melting department. Left and right in the foreground are the first- and second-stage melting furnaces.

* *An outline of all aspects of I.C.I. titanium production was published in our issue of March 8 last.*

After the ingot is cooled, the rough surface is machined off. This ingot is of 20in diameter and weighs 2,000 lb.



INNER EAR: An artist's impression—no exact details have been released—of the search-radar aerial inside the envelope of a Goodyear ZPG-2 airship (see "Indoor Aerial," below). Overall length of the envelope is 343ft.

HERE AND THERE

Under-Secretarial Solo

ON Wednesday last week the Under-Secretary of State for Air, Mr. Charles Orr-Ewing, made his first solo flight when he took off from White Waltham in a D.H. Chipmunk. Since his appointment as under-secretary last January, Mr. Orr-Ewing has been given flying instruction by S/L. D. P. Boulnois.

Shoulder Blades

A REPORT from America says that the U.S. Services are studying a "strap-on" helicopter — weighing about 68 lb — developed by Eugene Glubareff, a Californian aeronautical engineer. It consists of a gas turbine powering two 10ft rotor blades and is "slipped on in much the same way as a rucksack."

Argentine Air Minister

AN announcement in Buenos Aires last week said that Commodore Jorge Landaburn has been appointed Air Minister in succession to Cdre. Eduardo McLoughlin, who recently resigned. No official reason was given for Cdre. McLoughlin's resignation, but an amnesty he granted to officers concerned in an abortive Peronista coup last year had been opposed by some Air Force commanders.

Lockheed C-130B

A SECOND version of the C-130 Hercules —to be known as the C-130B and with "greater payload, greater range, and greater utility"—was announced jointly by the U.S.A.F. and Lockheed last Monday. Chief differences are the adoption of Allison T56 A-7 engines (with four-bladed propellers and higher engine/propeller gear ratio) and additional fuel tankage. The gross weight of the C-130B is 135,000 lb (C-130A, 124,000 lb).

Swedish Approval

IN Melbourne last week Hr. Sten Joste, leader of a four-man Swedish technical delegation visiting Australia to study the Jindivik, said Sweden considered it to be the best target aircraft of its type in the world today. The delegation is to spend eight weeks getting first-hand experience in operating and maintaining Jindiviks, ten of which have been sold to the Royal Swedish Air Board (with ground control equipment) for £400,000.

U.S.A.F. Policy

IN Washington on August 4 the Air Force Secretary, Mr. James Douglas, said that the U.S.A.F. "did not intend to follow the British lead and make a clean jump from planes to missiles." It expected to develop "an advanced heavy bomber and a nuclear-powered bomber" to follow the B-52. Mr. Douglas revealed that the Air Force was faced with a reduction of $1,000m (£357m) in its appropriation compared with the last fiscal year.

Sailplane Aerobatics

A SAILPLANE aerobatic contest is to be held at the site of the London Gliding Club at Dunstable Downs on Sunday, September 22, beginning at 11 a.m. Members of the Lockheed International Aerobatic Trophy panel of judges will award marks for accuracy of flying and showmanship. The Jack Hanks Trophy will be awarded to the winner and, it is planned, will be competed for each year.

Indoor Aerial

CONAD—Continental Air Defense Command — has revealed the fact that a Goodyear non-rigid airship, designated ZPG-2W (modified) is equipped with the largest search-radar aerial ever to be airborne. Also constructed by Goodyear, the aerial is carried inside the helium-filled envelope (drawing at top of this page). As in other ZPG airships, a radome on top of the envelope houses height-finding radar, but the usual search radome under the control car becomes unnecessary. Similar ships have made some notable endurance flights: last March a Goodyear ZPG-2 remained airborne for over 11 days without refuelling; and in January several of them maintained a ten-day radar watch 200 miles off America's eastern seaboard in weather which was said to be the worst for 75 years.

European Extension?

REPORTS from The Hague say that the Curtiss-Wright Corporation is planning to set up an assembly plant in Holland—at Haarlem, Utrecht or Den Bosch—to manufacture the company's products for delivery to Western Europe. Curtiss-Wright already has a small establishment at Schiphol Airport.

Australian-U.S. Co-operation

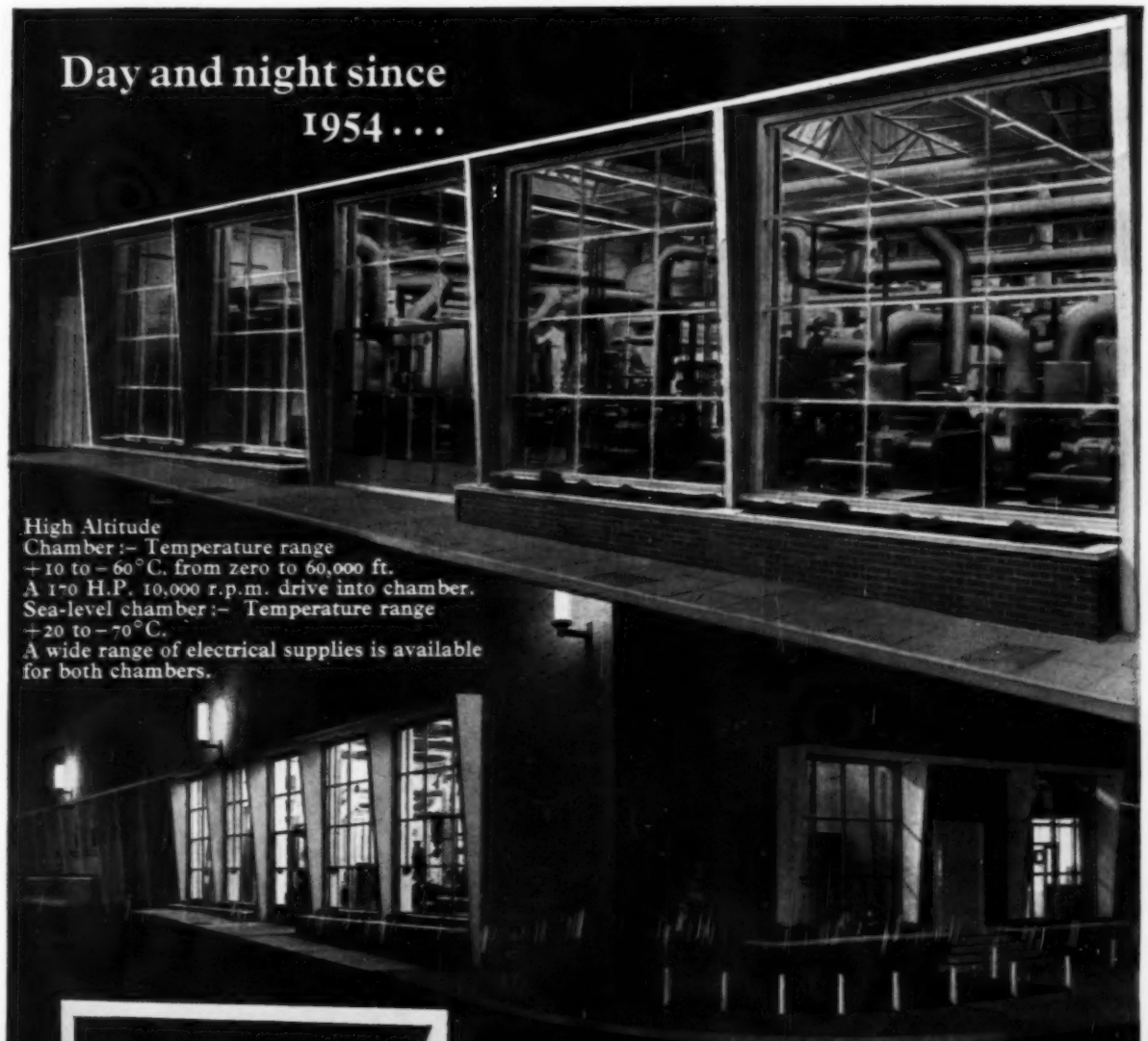
IN Sydney last week the Australian Prime Minister, Mr. Menzies, said that the recent defence mission to the United States had achieved "more than he thought possible." As a result of it, Australia could continue effectively her own aircraft production and would be in a position to co-operate with the U.S.A.—"at no real expense to ourselves"—on the development of aircraft which could be used by both countries.

Porsche Engine for XRON-1

THE Porsche company states that following a successful test installation of their Super engine in the American Gyrodyne XRON-1 ultra-light helicopter they have been given an order for a powerplant based on their light aircraft engine type 678. Porsche say this will give the XRON-1 [described in *Flight* for April 27 last year, p. 491] a cruising speed of "about 62 m.p.h." and make it "capable of lifting one man up some 13,000ft."

THE WHIPSNADE LION — a landmark familiar to London Gliding Club members, whose site is nearby—is a background feature to this pleasant impression of the second Hunting Percival Pembroke for the West German Air Force (thirty-three are on order).

Day and night since 1954 . . .



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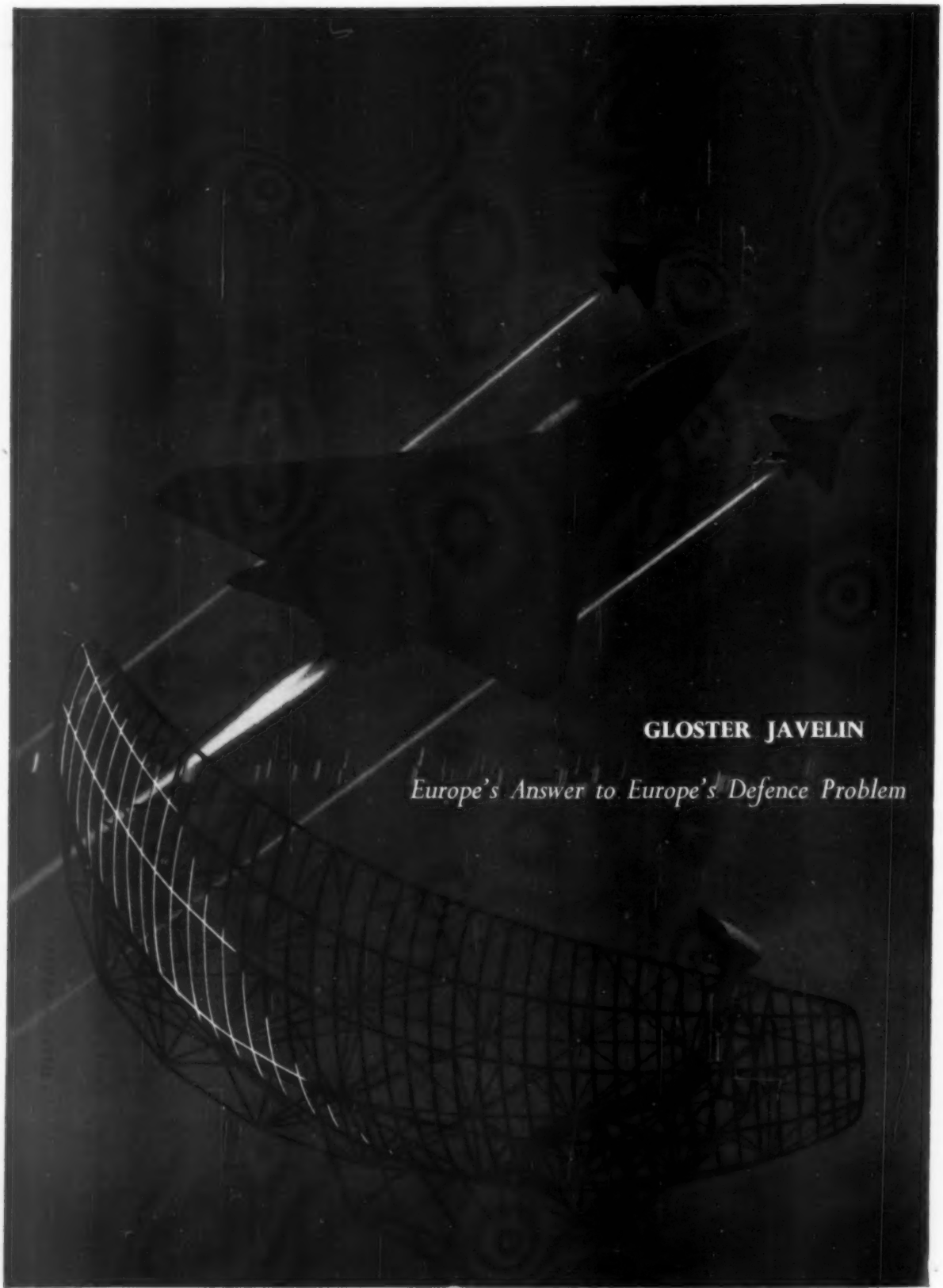

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THE AERONAUTICAL BOOKSHELF

"Mission Completed," by Air Chief Marshal Sir Basil Embry. Methuen and Co., Ltd., 36 Essex Street, London, W.C.2. Illustrated. Price 25s.

TWO-AND-A-HALF years after the end of the First World War, Basil Embry became a pilot officer in the Royal Air Force. He lived with the Service for the next 35 years, and the prime value of the book he has now written is as a history of the R.A.F. and as an autobiography. The author clearly had the ability to inspire others, whether they were members of a hard-pressed squadron or pupils of Bromsgrove School, where Embry was educated and where later, as an Old Boy, he went to distribute prizes on speech day. He still has that gift, and his book will transfuse some of the spirit of those days into those too young to remember them, and recall it to those who lived through them. It goes further than that; through each chapter runs the story of how the R.A.F. was welded into a Service capable of its epic operations between 1939 and 1945.

There are details of some of the well-remembered operations —the attack on Amiens prison and the release by bombing of scores of French Resistance prisoners; the destruction of the Gestapo headquarters at Copenhagen and Aarhus, and the bombing of V-weapon sites. It is clear that some of these operations were not quite so brilliantly planned and carried out as we believed at the time, although they were undoubtedly successful. The attacks on flying-bomb sites were completed with varying degrees of efficiency—the Bostons flown by the R.A.F. needed an average of 334 tons of bombs to knock out one site; but Mosquitoes used only 40 tons for the same job. Bostons lost two aircraft per destroyed site; Mosquitoes lost 0.87.

Mission Completed brings the conduct of the war to a personal level. To this extent it is perhaps egocentric, because it relates how Sir Basil saw the war, what senior commanders told *him* and how *he* carried out their orders. This may irritate some readers, but they should not let it detract from their interest.

Sir Basil was, in his own words, "prematurely retired" from the R.A.F. while he was Commander-in-Chief of the Allied Air Forces Central Europe. His stay in that post was stormy, and the later chapters of his book tell of many of the frustrations which he met. The last word on the military set-up of NATO has obviously not yet been written. Sir Basil's views on the subject are invigorating—which does not imply that they may not be a little prejudiced. But his whole book strikes one as being a faithful recording of his Service career, and leads one inevitably to think that there is probably a good deal of justification for his criticisms of NATO and the out-of-date attitude of some of the national forces in it. A. C. B.

"101 Nights," by Ray Ollis. Cassell and Co., Ltd., 37 St. Andrews Hill, London, E.C.4. Price 15s.

A MILLENIUM hence, *101 Nights* (the number refers to a squadron in Bomber Command) may be regarded as something of a Canterbury Tale. It records accurately the lives, atmosphere and conversation of operational aircrew on a bomber station and in the course of their pilgrimages over enemy territory. Characters in this novel are well cast; these men and women were to be found at most bomber stations during the war.

It is doubtful if any one crew nucleus ever ran into so much trouble in two tours of operations or thereabouts. But the story does indicate quite correctly that a crew which loses cohesion and good captaincy (whichever crew position the captain occupies) gets into difficulties.

The descriptions of operational flights are colourful and manage to give a true picture of what went on—though it is questionable whether they can accurately convey the scene to anyone who was not there; these things are beyond imagination. The accounts of flights must certainly excite vivid memories in anyone with some experience of ops.

By no means everyone enjoys war novels, whether based on true incidents or not. I for one usually avoid them and all they recall, and had no intention of doing more than skim this book. However, having made a start, I found it sufficiently gripping to want to read all of it.

Incidentally, it is strange that though the same slang, songs and expressions came up on all operational stations the words and even the point seemed to get altered as they were handed on without being committed to paper. It is easy to see how stories from the dim illiterate past of nations become so garbled through the generations that only expert historians can now trace them back to a common beginning in fact—and this particular piece of history takes the reader back less than fifteen years.

On another point, I personally welcome the use in print of words and expressions that are strictly non-drawing-room; blanks, Bowdlerizations and circumlocutions are dishonest and grubby. Men (and women) talked that way; it was part of the atmosphere. All types and many nationalities were mixed together and seldom can there have been such closeness and interdependence among "strangers." Few were conscious that by other standards they would have been considered foul-mouthed. Cut out the swear words and some men would be mute, as the book says.

No real hero or heroine (except perhaps the Lancaster) emerges, but there is no lack of characters. This is appropriate to the all-too-rapidly changing population and jumbled emotions and relationships of such a squadron.

As the Hitler War—Bomber Command's war—recedes in time and memory, each new book about it needs to be that much better to succeed—or even to be worthwhile. If this was Mr. Ollis's aim he has achieved it. M. A. S.

"Realities of Space Travel," edited by L. J. Carter. Putnam and Co., Ltd., 42 Great Russell Street, London, W.C.1. Illustrated. Price 35s.

HERE Mr. Carter has brought together the most up-to-date (publishable) theories about leaving the earth and getting away into space. *Realities of Space Travel* is a technical book to which 16 experts, including A. V. Cleaver, A. E. Slater and K. W. Gatland, have contributed. It is, therefore, a valuable work of reference for anyone who, idly or seriously, contemplates an excursion away from the planet Earth. The material in the book originated as papers presented to the British Interplanetary Society, and it speaks well of the high standard of that Society's work. A. C. B.

"Aircraft in Miniature," by W. O. Doylend. Model Aeronautical Press, 38 Clarendon Road, Watford, Herts. Illustrated. Price 12s 6d.

AN old hand at solid scale modelling, Mr. Doylend draws on long experience and presents the reader with a comprehensive guide to the art. Methods of making every component of a great variety of models are described at length, backed up by line and photographic illustrations of specific aircraft in every case. Look for sections on air-brakes, flap-guides, radial engines or World War I tail-booms: you will find them all. There is a particularly helpful chapter on hulls and floats, an aspect of modelling which discourages many.

Experts may carp at some of the author's dogmatic statements, e.g., on rigging: ". . . even the finest wire is unsuitable" (he prefers thread); but the beginner is certain to be satisfied.

Large photographs on art paper, many depicting the author's own models, give the book a "quality" air. It is perhaps unfortunate that the frontispiece illustrates a Hunter model with overgenerous wing fillets—which only shows that the last word on this absorbing hobby may never be said; but one unhesitatingly admits that Mr. Doylend has come pretty near to it. A. B.

OTHER BOOKS RECEIVED

Restrictive Trade Practices, by K. C. Johnson-Davies and R. D. Harington. Macdonald and Evans, Ltd., 8 John Street, London, W.C.1. Price 25s.

The Slide Rule for Sea and Air Navigation, by J. C. Podmore. Brown, Son and Ferguson, Ltd., 52-58 Darnley Street, Glasgow, S.1. Price 14s.

General View of Japanese Military Aircraft in the Pacific War. Compiled by the staff of "Aireview." Kanto-Sha Co., Ltd., Tokyo, Japan.

Seven Days to Never, by Pat Frank. Constable and Co., Ltd., 10 Orange Street, London, W.C.2. Price 15s.

Escape and Be Secret, by Charles Gibbs-Smith. Heinemann, 99 Great Russell Street, London, W.C.1. Price 15s.

Elements of Gasdynamics, by H. W. Liepmann and A. Roshko. Chapman and Hall, 37 Essex Street, London, W.C.2. Price 88s.

Proceedings of the Rubber in Engineering Conference. The Natural Rubber Development Board, Market Buildings, Mark Lane, London, E.C.3.

The Hunters, by James Salter. William Heinemann, Ltd., 99 Great Russell Street, London, W.C.1. Price 15s.

A Space Traveller's Guide to Mars, by I. M. Levitt. Victor Gollancz, Ltd., 14 Henrietta Street, London, W.C.2. Price 16s.

Management Control in Airframe Subcontracting, by Neil E. Harlan. Harvard Business School. Bailey Bros. and Swinfen, Ltd., 46 St. Giles High Street, London, W.C.2. Price 32s.

Subcontracting Policy in the Airframe Industry, by John S. Day. Harvard Business School. Bailey Bros. and Swinfen, Ltd., 46 St. Giles High Street, London, W.C.2. Price 32s.

NATIONAL GLIDING CHAMPIONSHIPS

THE sharp, angular yet subtle lines of the Skylarks; the brand-new shape from Newbury; a week's fair but undistinguished weather; a vigorous organization. These were some of the things that meant Lasham, 1957. The Surrey Gliding Club, its friends and helpers, had done it again; the National Gliding Championships had proved a big success.

It had been a joint effort. The success was due to the competitors, who had entered in numbers greater than ever before; to the voluntary officials; to the general public. To the Duke of Edinburgh, Patron of the British Gliding Association, who had flown in on the first day to see for himself the sport of gliding; and to the Boy Scouts whose efforts also formed part of the championships.

Only one snag remained—the old problem of security of tenure at Lasham Airfield. Two years ago we had thought, hopefully, that the bright success of the 1955 Nationals would convince Authority that a one-month security string at Britain's largest gliding centre was just not good enough. This year, wiser and with more experience of officialdom's philosophy of complacent inactivity, we expected nothing. We simply went ahead and enjoyed our flying.

Reports in the last two issues of *Flight* have covered the opening stages of the championships and the main results. This article describes the final days of the meeting.

The morning of **Thursday, August 1** was again cloudless, but hazy and warm. League 1 pilots, most of whom had completed the 200 km triangle the day before, were briefed at 9 a.m. for distance along a set line from Lasham through Park Head, on the Cornish coast near St. Merryn. In this task points are given for distance but a landing away from the line is penalized. Just in case anyone reached the coast, Ann Welch disclosed that high tide at Park Head was at 3.30 p.m.

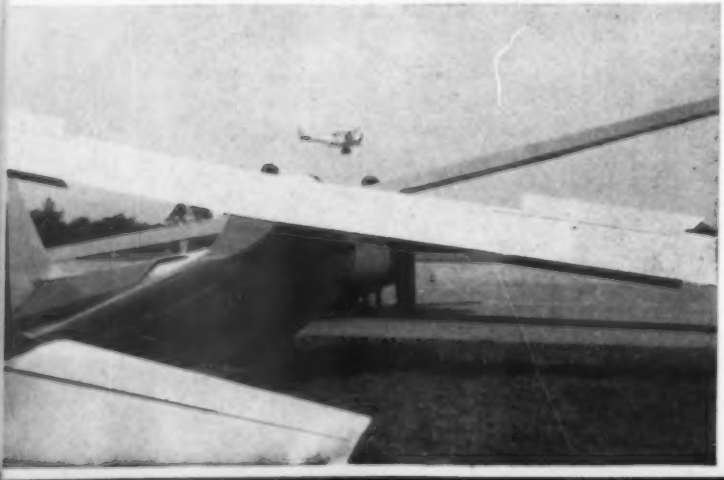
The sailplanes would have a light tailwind but conditions would be difficult once again because of a low inversion which would restrict heights to about 4,000ft. The poor visibility and the possibility of the cool sea air reducing convection over Cornwall were additional hazards.

League 2 pilots, who had been returning during the night from landing places as far afield as Swansea, Shrewsbury, Leicester and Littlehampton, were given an easier task. Their race was around a 54-mile triangle with Andover and Inkpen Beacon as turning points. They were not to be launched before 1 p.m. when, it was hoped, the senior pilots would already be on their way to Cornwall.

The haze became thicker during the afternoon but almost all the sailplanes were away by 3 p.m. Landing reports soon began to come in and, four hours later, the picture was complete. In League 2 the 40 aircraft were strewn along the triangle and none had been able to complete the course. John Mackenzie (Olympia) of the Surrey Gliding Club flew farthest and was forced to land only seven miles short. Peter Scott (Eagle) was runner-up.

The 26 pilots flying in League 1 had obviously found the hazy conditions equally difficult. Only eight were successful in crossing Dorset and these all rounded Dartmoor to the north and landed between Okehampton and Tintagel. David Ince (Skylark 3) achieved the day's best distance of 160 track miles to Tintagel, and other good distances between 100 and 152 miles were flown by Tony Goodhart (Olympia 403), Tony Deane-Drummond (Skylark 3), Andy Gough (Skylark 3), Nick Goodhart (Skylark 3), Peter Bisgood (Sky), John Williamson (Weihe) and Dan Smith (Sky). Philip Wills was one of those who were forced to land in Dorset (track distance 73 miles) and he thus slipped from first place. The leaders at the end of the fourth contest day were:—

League 1	pts.	League 2	pts.
1. Tony Goodhart ...	348	1. Mackenzie	348
2. Deane-Drummond	345	2. Mann	319
3. Nick Goodhart ...	344	3. Day	299
4. Ince	340	4. Garrod and Bentson	289
5. Wills	320	5. D. Ellis	264



Two Olympias and a Sky had been damaged in the previous day's flying and today Dan Smith's Sky had broken its fuselage on landing—without injury to the pilot.

Each national contest, it seems, must have its "Glider lands in field, attacked by cows" story, and this year was no exception. In 1955 it was John Holder and today it was Ben Lastowski. The Polish Club's red-and-white Olympia received a sound licking by a herd of Jersey cows, led by a bull, in a field near Newbury, but suffered no major damage.

It was notable at this stage that the highest-performance sailplanes (Skylark 3 and Olympia 403) were filling the top places in the senior League. It is always difficult to separate the performance of the pilot from that of his glider but the lack of any outsiders was confirming the seeding and the superiority of the high aspect-ratio machines.

On **Friday, August 2** the fine, hazy weather continued and pilots again circled in dry thermals extending to only 4,000ft. This limited height meant that the pilots could afford few mistakes, otherwise they would be too low to contact another thermal, and the poor visibility necessitated constant map-reading. League 1 were given a race to the site of the Bristol Gliding Club at Nympsfield, 65 miles away in the Cotswolds. League 2 were to fly along the set line to Cornwall which had been attempted the day before by League 1.

In spite of difficult conditions almost all competitors succeeded in going away after their first aero-tow. The excellence of the standard of flying is indicated by the completion of the League 1 race to Nympsfield by all pilots except one—and he landed only half a mile short. The best time was by Frank Foster, who took 1 hr 30 min—a notable performance in his Skylark 2. Philip Wills found himself desperately low at one point near Chippenham and avers that he was spurred on by the contemptuous look in the eyes of some chickens. The speeds of the four leaders were so similar that no great changes of position took place.

The Army Gliding Club's Skylark 2 flown by John Cotton, the only one to land short at Nympsfield, had suffered major damage on landing; and an indication of other pilots' misfortunes that day was later given as several of the returning cars towed their trailers straight to the workshops on reaching Lasham. At midnight the brightly lit workshops were crowded and busy . . . the London Club's Sky *Elizabeth*; the Surrey Club's Olympia *Green-O*; Frank Foster's Skylark 2 (rear fuselage damaged on hard landing at Nympsfield); and the wing of Geoffrey Stephenson's Skylark 3, which had had a brief encounter with a Nympsfield winch.

The door opened and Peter Scott walked in carrying the skid from his Eagle two-seater. The craftsmen from Kirbymoorside

Winners of Leagues 1 and 2: Lt-Col. A. J. Deane-Drummond (left) and Edward Day. Below, left, a Tiger comes in behind two Skylark 3s.

and Lasham, the pilots and their crews, obviously had little time for gossip, and so we tactfully adjourned to the Press office, just in time to hear an Agency man on the telephone dictating ". . . from most points of view the championships have been the most successful ever held by the British Gliding Association." Notwithstanding the apparent irony at that moment he was, of course, absolutely right.

The League 2 pilots had not been as successful in their set journey towards Cornwall as their seniors had been the previous day. Many had landed after only a few miles; most managed to reach Dorset. Edward Day landed exactly on track north-west of Exeter at a distance of 116 miles from Lasham, and other flights of over 100 miles were made by Anson (Olympia), Rutherford (Skylark 2), Mackenzie (Olympia) and Kearon (Olympia).

FINAL DAYS OF AN OUTSTANDING CONTEST: EXCELLENT PERFORMANCES AT LASHAM

By KENNETH OWEN and ALAN YATES

ILLUSTRATED WITH "FLIGHT" PHOTOGRAPHS

Now that there had been five contest days a new factor took effect. The contest rules allow a pilot to ignore his worst day's score and, although the organizers continued to determine the leaders at this stage on the basis of total points, the best-four-days figure was clearly a more realistic guide. The results after five contest days (four-day total in parentheses) were as follows:—

League 1	pts.	League 2	pts.
1. Tony Goodhart	443 (366)	1. Mackenzie ...	439 (378)
2. Nick Goodhart	437 (375)	2. Day	399 (367)
3. Deane-Drummond ...	436 (373)	3. Mann ...	347 (319)
4. Ince	429 (361)	4. D. Ellis ...	333 (314)
5. Wills ...	386 (347)	5. Garrod and Bentson ...	323 (289)

A brilliant blue sky greeted the holiday weekend on **Saturday, August 3.** Retrieving car drivers would have preferred to stay at Lasham and some pilots might even have welcomed a rest day. The organizers were stern, however, and ordered League 1 to fly as far as they could—a free distance task—and League 2 to race to South Cerney R.A.F. station, 52 miles to the north-west. Retrieves avoiding the more-crowded main holiday roads were possible from South Cerney.

Second and third in League 1, the redoubtable Goodhart brothers: (below) Nicholas, with crew-member Betsy Woodward, and (right) Tony, complete with flying hat and non-flying parrot.

When free distance had been set three days before, the landing places had varied from South Wales to the East Midlands—but that had been in conditions of little wind. Today was different. There was a brisk, easterly wind at Lasham which would weaken and become more southerly in the Midlands. Flights to the west seemed ruled out by the high cloud reported over the western half of the country. This cloud would not be sufficient to interfere with the race but would probably force the experts of League 1 to fly north from Lasham. Once again blue thermals up to about 4,000ft and moderate visibility were expected.

A final warning note was added by Ann Welch at the briefing. Following landings on the playing field of Sherborne Girls' School on Thursday and Friday, the caretaker had warned the last pilot (Brig. J. Dickson, Skylark 2) that further touch-downs there that week-end were not advisable—the gates would be locked until Tuesday.

First away at noon was Nick Goodhart's Skylark 3, rapidly followed by the other League 1 pundits—Wills, Deane-Drummond, Ince, Tony Goodhart and the rest. League 2 take-offs began at 1.30, and all were away by three o'clock.

The edge of the cirrus sheet moved across Lasham during the afternoon. For the League 1 pilots who were heading north the problem was to keep to the east of the cirrus-covered area in spite of a south-easterly wind blowing them back in to it. The League 2 pilots, *en route* to South Cerney, had no choice, but even under the high-cloud cover there was convection—if only of limited depth. Pilots reported later to met-man Wallington that they had obtained good lift from woods and scrub areas, up to a maximum height of about 3,800ft.

By tea-time on Saturday, League 2 pins in a thick line on the control-tent map were marking the track to South Cerney. League 1 were dotting the country to the north with the exception of Gough in the R.A.F. Skylark 3, who was 103 miles away in Wales—in Brynmawr Rugby football ground, to be precise, where he had landed at 4.50 p.m. Deane-Drummond and Ince had each achieved about 112 miles in flights to Ashby-de-la-Zouch and Tamworth; while Wills had landed just short of the 100-mile circle, near Hinckley.

Two of the latest landings proved to be the day's best. Everyone had been wondering how far Nick Goodhart would make, since for some time he had been the only leading pilot unaccounted for. The answer was 145 miles, to Daisy Knowle Farm, near Buxton, where he landed at 5.40. Ten minutes later John Williamson put the Surrey Club's Weihe down at Clunbury, Shropshire, a distance of 119 miles.

A revealing note included in Frank Foster's landing report was "pilot asleep under wing," after a 75-mile flight to the playing fields of Prince Henry's Grammar School, near Evesham. Foster and crew-man Arthur Doughty had been working on their Skylark 2 in the workshops till 4 a.m., and again from 6 a.m. until just before take-off at two o'clock. It was generally agreed that he had a right to be asleep.

In League 2, six aircraft had arrived at South Cerney, the best time being 1 hr. 39 min. by Edward Day's Sky. Rutherford (Skylark 2) and Cochrane (Skylark 2) each took 1 hr 47 min; followed by Stark (Army Gliding Club Skylark 2, 1 hr 54 min), Cockburn (E.T.P.S. Olympia, 2 hr 5 min) and Peter Scott (Eagle, 2 hr 8 min).

On total points (best-five-day score in parentheses), the leaders were:—

League 1	pts.	League 2	pts.
1. Nick Goodhart	537 (475)	1. Day	499 (467)
2. Deane-Drummond ...	510 (447)	2. Mackenzie ...	445 (439)
3. Ince	502 (434)	3. Scott and Collier ...	358 (356)
4. A. Goodhart	498 (443)	4. Garrod and Bentson ...	356 (323)
5. Gough ...	452 (383)	5. Mann ...	347 (347)

Separate briefings for each League were held on **Sunday, August 4.** At 9 a.m., League 2 were given the test of pilot-declared

General scene at the launching point, with the Polish club's Olympia (pilot Lastowski) in the foreground.

NATIONAL GLIDING CHAMPIONSHIPS . . .

goal, and at eleven o'clock League 1 were given the same task. The only difference in the scramble to select launching times was that at nine o'clock the launch-board was just outside the briefing tent, while at eleven it had been moved to the end of the runway. The respective races to the board accordingly involved (a) a short dash and (b) a sprint to one's car followed by an urgent car-race along the perimeter track.

The weather was going to be tricky. Workable if shallow thermals would develop over Lasham by midday but there were two areas of eight-eighths medium cloud, one to the west and one north of Lasham, in which ground-heating would be reduced. There was medium-level instability but little chance for pilots to contact it. The two cloud areas in fact indicated the crests of a very long (150-mile) wave—not the soarable kind—and the whole pattern was moving slowly north-east. Winds at 3,000ft were south-easterly.

Selected goals were generally to the north-west. Most ambitious were the twin Welsh-coast resorts of Rhyl and Prestatyn, chosen by Wills and Lorne Welch respectively. Deane-Drummond declared Hawarden Airfield near Chester, while for Nick Goodhart it was Hooton Park, a few miles farther on into the Wirral peninsula. Other goals included Halfpenny Green Airfield, Wrexham, Long Mynd, Little Rissington, Shobdon and Burtonwood. Early take-offs, just before noon, were not successful and spectators had the unusual sight of the League 1 leaders circling low over the runway before being forced to come in and land for a second attempt.

Several then decided on more modest goals in view of the difficult conditions: Nick Goodhart changed to Cosford and Ince from Rhyl to Bishops Castle. By Sunday evening the landing pins in the control-tent map were sprinkled in a cone to the north-west of Lasham. An early surprise had been that Nick Goodhart had come unstuck at 2.30 p.m. at Stanton Harcourt Airfield, a distance of only 42 miles. Goal flights had been successfully completed by Scorer in the R.A.F. Grunau (Kemble, 56 miles), Hodgson (Skylark 2, Nympsfield, 65 miles), Morison (Nimbus, Warnborough, 38 miles)—and also, it must be recorded, by John Holder who, determined to complete at least one task with success, had noted the minimum scoring distance of 20 miles and had declared Andover, a modest 1.6 miles farther on.

Soon after six o'clock came news of four outstanding League 1 flights. Deane-Drummond, incredibly, had made Hawarden—a goal flight of 163 miles on what would not previously have been considered a cross-country day at all. Tony Goodhart had overflown—and almost doubled in distance—his goal of Pershore, to make 154 miles to Wrexham; Wills had achieved 150 miles in the same direction; and the amazing Derek Piggott had coaxed the prototype Eagle two-seater 151 miles to Calvely Airfield, home of the Cheshire Farmers' Association near Nantwich. Second-best goal was that of Bisgood in the E.T.P.S. Sky, who achieved 107 miles to Halfpenny Green.

Among the day's incidents recounted at the end-of-comps. party later that evening were those which had involved respectively Wally Kahn and David Kerridge—and their Olympias. Kahn, whose goal had been Defford, landed at Brize Norton U.S.A.F. Base, and duly filled in the regulation form on arrival. Under the "Reason for landing" heading he put simply "flame-out." David Kerridge, having left his Olympia in a field and accepted the hospitality of a nearby farm, had returned to find the sailplane minus a large area of rudder and a number of cows munching contentedly alongside the fuselage.

Between 5.30 and 8.30 next morning, **Monday, August 5,** Wills, Tony Goodhart, Piggott and Deane-Drummond arrived back at Lasham. At the League 1 briefing at 11.30 no task was declared, for the weather was marginal and it was not desired to introduce an unnecessary element of luck into the results at this stage. League 2 at an earlier briefing had been set a short triangle with turning points at New Alresford Pond and Farnham Castle, but the minimum performance necessary for a contest day was not achieved and so the competitions ended with no alteration to the scores after Saturday's flying. Deane-Drummond, runner-up in 1955, was the new British national champion, while League 2 was headed by Edward Day of the Kent Gliding Club in his Sky. The final leaders in both Leagues (six-day points total) are given in the table below.

FINAL PLACINGS

	pts.
League 1	
1. Deane-Drummond (Skylark 3)	547
2. N. Goodhart (Skylark 3)	537
3. A. Goodhart (Olympia 403)	515
4. Ince (Skylark 3)	502
5. Wills (Skylark 3)	479
6. Gough (Skylark 3)	452
7. Williamson (Weihe)	438
8. Bisgood (Sky)	397
9. Warminger (Skylark 3)	378
10. Foster (Skylark 2)	377
11. Irving and Minton (Skylark 3)	361
12. Piggott (Eagle)	351
League 2	
1. Day (Sky)	499
2. Mackenzie (Olympia)	445
3. Rutherford (Skylark 2)	403
4. Torode, Burton and Martlew (Petrel)	382
5. Scott and Collier (Eagle)	379
6. Anson (Olympia)	366
7. Garrod and Bentson (Olympia)	356
8. Kearon (Olympia)	351
9. D. Ellis (Olympia)	350
10. Mann (Gull 4)	349
11. Cochrane, Aldridge and Palfreeman (Skylark 2)	335
12. Hands and Dodd (Skylark 2)	320

Prizes were presented by Lord Brabazon on the final day of the meeting. They included the *Londonderry Cup* (individual winner in League 1), A. J. Deane-Drummond; *L. du Garde Peach Trophy* (team winner in League 1), F. G. Irving and P. Minton; *Furlong Trophy* (individual winner in League 2), E. Day; *Firth Vickers Trophy* (team winner in League 2), J. E. Torode, G. Burton and D. Martlew; *Kemsley Cup* (club glider with highest placing) and *Eon Cup* (highest placing of numerically strongest type in championships, i.e., Olympia), J. K. Mackenzie, Surrey Gliding Club; *Slingsby Trophy* (highest placing of numerically strongest two-seater type, i.e., T.21B), R. C. Jones and W. Verling, A.T.C./R.A.F.; and the *Pan American Airways Trophy* (best performance by a club not eligible for Kemsley Cup), A. Gough, R.A.F.G.S.A. Wessex Club.

Special prizes included one for the most consistent performance, to an embarrassed but amused R. A. Young (Schweizer 1-26A) whose daily scores had been 0-4-0-0-0-0-0; and one to the best woman competitor—which went to the *only* woman competitor, Mrs. R. Harwood. A prize for the best two-seater flight was awarded to A. D. Piggott and C. Tippitt.

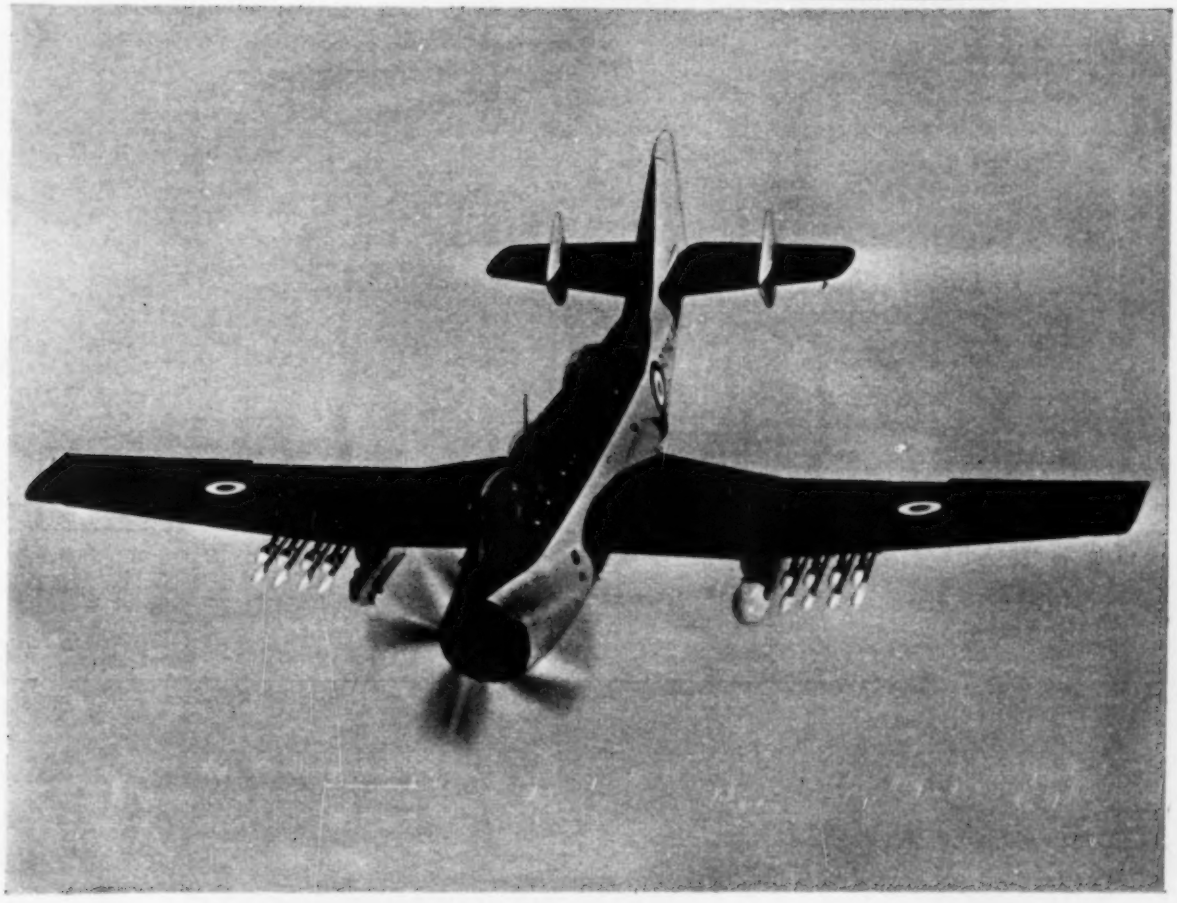
And now the Nationals were over. We had seen perhaps the best-ever example of task-setting expertly and consistently tailored to tricky weather conditions—proof was abundant in the high performances attained. Pilots had flown every day within the limited height-band imposed by anticyclonic conditions. One experienced pilot confessed, "I'm just not an anticyclonic man," and there were many others. Nobody had had occasion to use oxygen, not even this country's highest-soaring pilots, Piggott, Warminger and Williamson, all of whom had been among the competitors.

We looked at the results board after the prizegiving and talked of the launching, the flying, the last-night party. Aero-tows at the rate of 70 in under an hour and a half, we recalled. Deane-Drummond's goal flight to Chester; 25 aircraft really racing to Nympsfield—not merely trying to get there; 18 pilots around a 200 km triangle on an ordinary sort of day. A run of seven consecutive contest days. It had been a good meeting.

Today it was over and tomorrow we would exchange our shorts, exuberant headgear and sports-shirts decorated with modernist fish for more-sober suits, collars and ties and probably umbrellas. We should sit, not on the grass at Lasham, but in offices in London and a hundred other places. But it had been a *very* good meeting.

Elliotts' Olympia 403, completed just before the contest and flown by Tony Goodhart, features an all-moving tail and increased-area fin and rudder.

FAIREY GANNET



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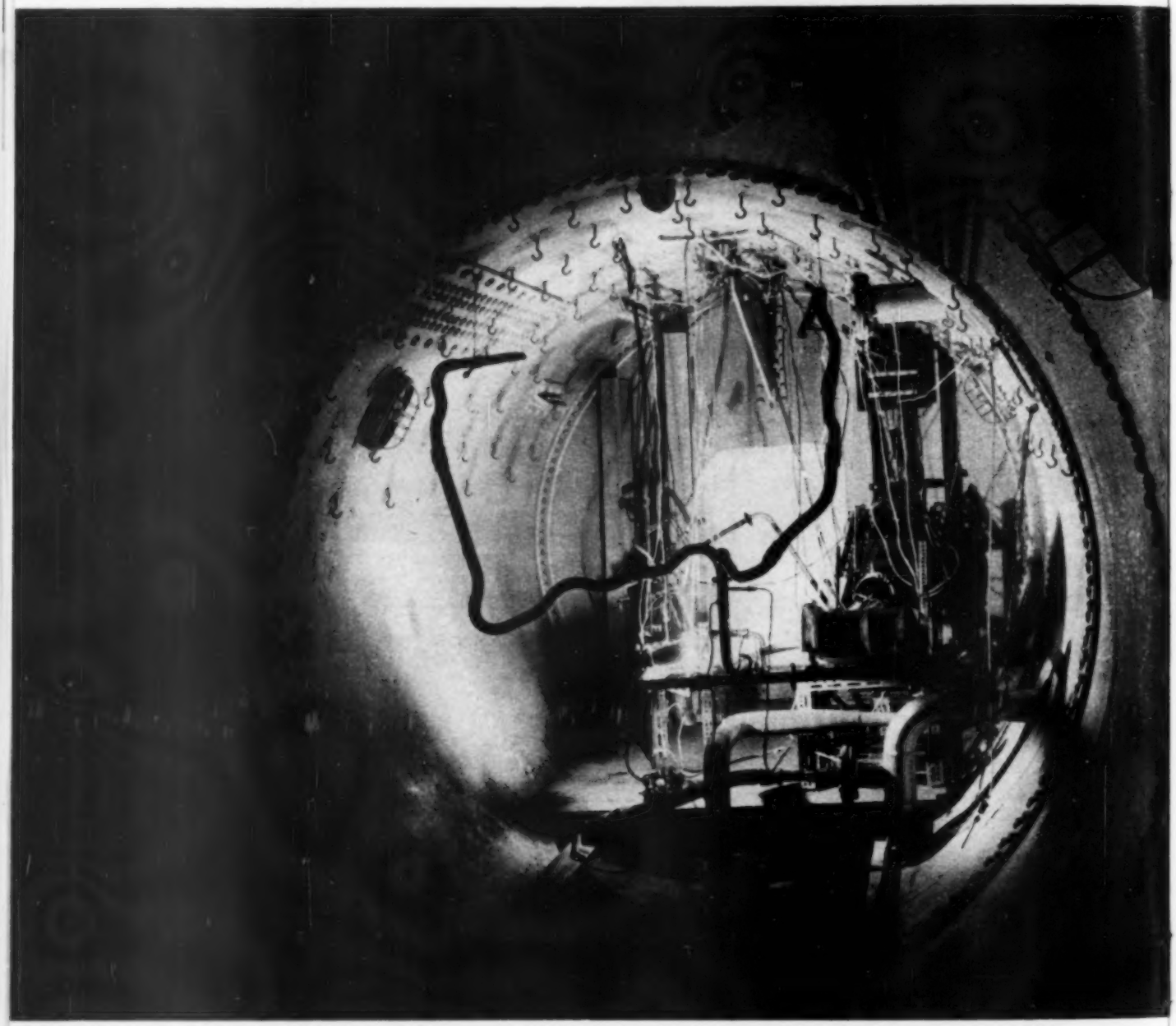

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The familiar whine of multiple Ghosts is heard again in the land—emanating from the R.C.A.F. Comet 1a (left), newly modified at de Havilland's Chester factory. The Bréguet 1001 Taon light ground-attack fighter—the lower of the aircraft depicted—made its first flight on July 26. It is powered with a Bristol Orpheus. Note leading-edge droop-snoot.

AIRCRAFT INTELLIGENCE

U.S.A.

Republic V.T.O. Now under study by the Republic Aviation Corporation is a V.T.O. project for the U.S.A.F. Single and multiple powerplant installations are being considered and the machine would take off in a horizontal attitude. The General Electric J85 is thought to be the most promising power unit for this application.

Chance Vought F8U-3. A powerful rocket motor built by Reaction Motors, Inc., is to be fitted to one version of the Chance Vought F8U-3 naval fighter in addition to the Pratt and Whitney J75 turbojet. Speeds well above Mach 2 are expected.

Lockheed C-130A Hercules. A Hercules turboprop transport of the U.S.A.F. has remained airborne for 14 hr 1 min. It was manned by multiple crews and flew a random course over North Georgia at heights between 5,000ft and 30,000ft. Four thousand U.S. gallons of fuel were consumed.

Hiller H-23D. This Hiller helicopter has been put into production with a view to obtaining lower operating costs through longer overhaul cycles and has already completed a 1,000-hr accelerated ground-endurance test at Palo Alto. The drive system is completely new.

Beechcraft E50. Three E50 Twin Bonanzas have been ordered by the Swiss Air Force for liaison work. With their supercharged Lycoming 340 h.p. engines, these aircraft are well suited to Swiss conditions. The Moroccan Government has ordered two E50s. All five aircraft are to be delivered this month.

France

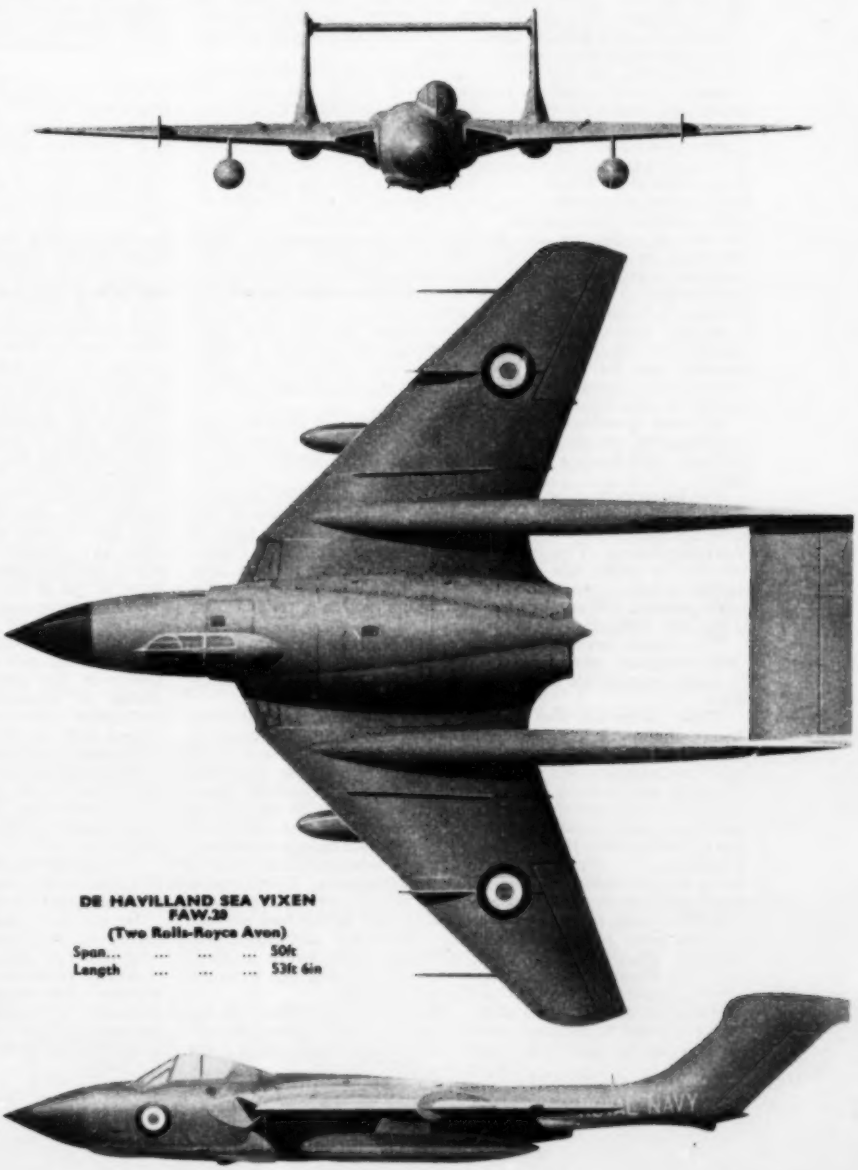
Fouga Magister and Magister Marine. Two Fouga Magister Marine trainers have been at Cherbourg undergoing deck-landing trials aboard the British aircraft carrier H.M.S. *Bulwark*. The tests are being made by Jacques Grangette and officers of the French Aeronavale. Meanwhile, it is learned that the 81st Magister has been delivered and that the present production rate of eight a month will soon be raised to 12. A second Magister, with powered ailerons, will soon be sent to Mont-de-Marsan for tests, and all Magisters will eventually have this feature. More than ten Magisters have been flown from Toulouse to Germany by German crews.

Germany

Air Force Transport Equipment. The first of 20 Douglas C-47 Dakotas has been delivered to the German Air Force from Erding Air Force Base. These aircraft will fill the gap until the arrival in quantity of Noratlases.

Communist China

Fighter Equipment. General Wang Shu-Ming, commander of the Chinese Communist Air Force, has said that Mig-19 jet fighters—"capable of 800 m.p.h."—have appeared in Communist China. They are being flown, he added, in the Shanghai, Peking and Ningpo areas by Russians.



An Il-14 parked outside the terminal building at Khabarovsk airport (built in 1949). Russia's terminals are all designed in the classical style.

PART 2

More About Aeroflot, Russia's Airline Organization

By CLIVE JENKINS

CONTINUED here is the first-hand account—exclusive to "Flight"—of a tour of Russia's great Aeroflot organization made by a British delegation from the Airways Section of the Association of Supervisory Staffs, Executives and Technicians (of which the author is transport industrial officer). A third instalment will follow.

IN addition to the College at Kiev and its satellite correspondence centres another specialized agency exists at Leningrad. This is the Higher Aircrew Training Institute, which turns out pilots, navigators and radio officers, who are also given operational-management training.

In this way, and from these long-established centres, Aeroflot receives a steady stream (although still much too small) of technicians and managers all trained to a specific standard and examined by an outside commission.

After graduation these young men's records come under the scrutiny of a central personnel section in Moscow. This secretariat keeps track of all bright young workers and, with the approval of their union, nominates them for promotion or special advancement when vacancies occur. This occurs frequently, owing to the rate of expansion and the fact that re-equipment is being paralleled by an extraordinary rate of construction. Within the next four years the following major developments are planned for completion: 13 new airports; a complete reconstruction of Vnukovo's facilities, including the terminal, plus the building of a 400-bed pilots' hostel and a large airport workers' club; new hangars for the Tu-104 line maintenance at Vnukovo; a major overhaul base for Tu-104s; new hangars at Leningrad. In addition to this list numerous schools, hospitals and crèches are planned, as well as a big flat-building programme.

All these questions come within the purview of Aeroflot and, in particular, its director of construction, Gerassim Ivanovitch Stolarev, who heads a large (but seasonal) direct-labour building force.

The housing situation is still critical, and in April 1957 Stolarev addressed a preliminary session of the central committee of the Civil Aviation Workers' Union on his plans for the acceleration of flat-construction. This is not his only pressing problem. Everyone on the traffic side is becoming aware that all the fine new terminals built since the war (excellent though they are) are badly underplanned and will be swamped by the growth in traffic which it has now been decided to achieve.

The present terminal buildings are all of classic exterior design (with marginal concessions to local architectural traditions) and in many instances are faced with marble. They all look remarkably alike.

These places are also all basically of the same ground plan. In six of them I found an almost identical layout. On entering the main hall, decorated by murals and slogans, and sometimes with oil paintings, one sees a wing to the left and to the right. The left wing usually has a lounge, a "mother-and-child" room (with cots and toys for tired children—who can be left in the charge of a nurse) and sometimes a souvenir shop. The right wing has a booking-hall (looking rather like a British branch bank) and a restaurant. A transit hotel usually lies beyond and almost always has a white-bearded commissionaire in attendance. These transit hotels are covered when necessary by the price of the ticket, and accommodation is free if the aircraft is held up by bad weather (as frequently happens in Siberia, where great turbulence is a constant menace). The traffic girls are often not in uniform and are difficult to identify. Some of them are language students, working during their vacations, or school teachers.

Passenger processing is slow. The regulations printed on the ticket demand attendance at the airport an hour before take-off. In practice this has been relaxed in all cases except the Tu-104 services, and a local passenger can join even ten minutes before departure. But international flight regulations are much stricter; attendance at least 30 minutes early is insisted upon. The Tu-104 is an exception because of its passenger numbers. They say that the hour is needed to process them and prepare the trim sheet. Another point is that the Tu-104 has to have its fuel consumption lowered by towing it to the end of the runway. And timetable departure times are always *airborne* times for all aircraft. Aeroflot is now planning town-terminal processing for passengers on the larger aircraft coming into service.

In order to avoid an elaborate central bookings organization it has been a rule that reservations cannot be made more than ten days in advance of the date of travel. Apparently, if an aircraft then becomes overbooked a "relief" is placed in service from the huge Ilyushin fleet. From the questions put by the eager, but worried, Soviet traffic officers it is clear they realize that the system is going to need urgent revision with larger and larger aircraft coming into service with higher operating costs. They are also thinking of scrapping the system of controlling passengers in transit which is based on the stewardess tearing slips from the ticket held by the passenger when his journey terminates in another territory.

Some of the senior traffic-handling personnel are extremely young. The chief traffic officer at Leningrad at the time of our visit was 25 years old. One of his counterparts at Vnukovo is a brisk and plumply competent Intourist-trained 24-year-old girl with a good command of English. She is obviously going to have some of the greatest difficulties of any Russian ground services officer as more and more international airlines fly into Moscow.

This is realized by the Central Board. Vnukovo is the only airport where the commandant is separated both from the "squadron" attached to it and from the Line Maintenance. The present holder of this position, Stepan Simeonovitch Zapilonov, is in charge of permanent structures which have been basically unchanged since the airport was built in 1937. It is now being ripped apart to cope with the increase in traffic.

Zapilonov explained that he was greatly dissatisfied with the existing facilities but that all the overcrowding should be relieved within 1958. He went on to detail the present traffic position. There were now 220 daily movements by the timetable, plus a large number of "specials" for mail and cargo and occasionally for passengers, too.

The airport has two concrete runways which are able to handle all traffic by day or night; company weather minima are 300 yards' visibility with a height of 30 yd.

He told us he had three aircraft under his control for meteorological purposes only. The Line Maintenance organization was split into two parts, Tu-104s and "others." The latter included maintenance for foreign airlines as well as neighbouring territorial boards. The superintendents of both sections reported to the Moscow Territorial Board but the "heavier maintenance" (i.e., turbojet) had a responsibility to Aeroflot's Central Technical Control. The work of the commandant was, therefore, restricted

"Flight" photograph

(Left) Svetlana Kalinin, an air stewardess on Ilyushin aircraft serving Ukrainian routes, pictured before checking in at the Kiev terminal. Twenty-four years old, an ex-children's teacher, she is married to a film actor. (Centre) Stewardess in the midships galley of the Tu-104. The plastic cabinets in the foreground hold porcelain figures riveted to the shelves. (Right) Alan Harris (B.E.A. duty officer at London Airport Central) compares procedures with a 24-year-old English-speaking ground services supervisor at Vnukovo.

to the provision of all other ground services for a daily average of 1,500-1,600 passengers both departing and arriving.

Moscow, too, has a "peaking" problem. The maximum carried, in and out, in one day (normally during July and August) is around 1,700, but this can fall to 800 in January and 900 in other winter months. The annual average is now moving up from 500,000 passengers in and out: 1957's figures are 25 per cent up on last year—but this is thought to be unsatisfactory.

The commandant said he had a total staff (including building workers) of approximately 2,500, which included an upward fluctuation for the summer period.

In discussing the work of his station organization Zapilonov gave the following facts (after mentioning he had visited London Airport with the Bolshoi Ballet—and been impressed) during a tour of the departments.

Air traffic control (as at other Soviet airports) is done from the airport itself. Vnukovo is a regional traffic control centre for a radius of 500 km and regulates five air lanes. At a given point on each route it hands over the despatched aircraft to the "airport of first landing." On July 6 there were 12 morse keys to be seen in communication with these receiving airports. There was also a teleprinter network, using a battery of 16 machines to link Vnukovo with these airports and the other three "local" airports in the Moscow area.

Alongside these rooms we saw a weather briefing office for pilots where two-hourly charts were being continuously prepared, while a main synoptical chart, hanging on the wall, and prepared each day, gave the weather position from Africa throughout Europe. The meteorological section had 14 teleprinters pouring in a steady stream of information from the rest of the U.S.S.R. and most parts of Europe.

Vnukovo's transit hotel at present has 200 beds, but this total is to be increased, together with separate accommodation for air-crew. Every airport has a hostel for crews, where they have to stay when "slipped" or in transit. These conditions would, undoubtedly, irk British crews, but in Russia such rules are accepted as contributing towards the safety of the airline. While in the hostel the crew are under medical care and are examined before departure. If alcohol has been taken in the previous 24 hours permission to fly is refused. The management also makes special efforts—contrary to Western practice—to keep the crew (excepting the stewardess) together as a unit, believing that efficiency is greatly improved by such means. The new hostel will have 400 beds.

By British Airways Corporation standards the existing catering section is extremely backward. This is probably because Aeroflot has only just commenced serving *any* hot meals in the air—and these only on the Tu-104 (where you get caviar and chicken-with-rice, plus an apple and sweet biscuits). This is the only service, too, where drinks are available—Georgian wines and cognac. On all other flights meals are served on the ground and are charged to the passenger. Refreshment in the air is confined to tea, minerals, and snacks (see menu overleaf).

Often the stewardess is not in uniform. Moved by curiosity I asked a Ukrainian stewardess if she *had* a uniform. She looked shocked and said "of course." "Well, why aren't you wearing it?" She dismissed this silly question with a roguish smile, saying "Girls look pretty in anything." I gave it up. Aeroflot didn't seem to care. The passengers certainly didn't: many of them obviously were old friends and called to her by her first name; frequently they engaged her in conversation—standing up while the aircraft was landing. (But we were told by the deputy head of the Scientific Research Institute in Moscow—which lays down operational standards—that seat belts were about to be made mandatory. He added that Aeroflot would gradually commence to adhere to all international recommendations. He had himself been to the Third Air Navigation Conference of I.C.A.O. in Montreal last September as a part of this process.)

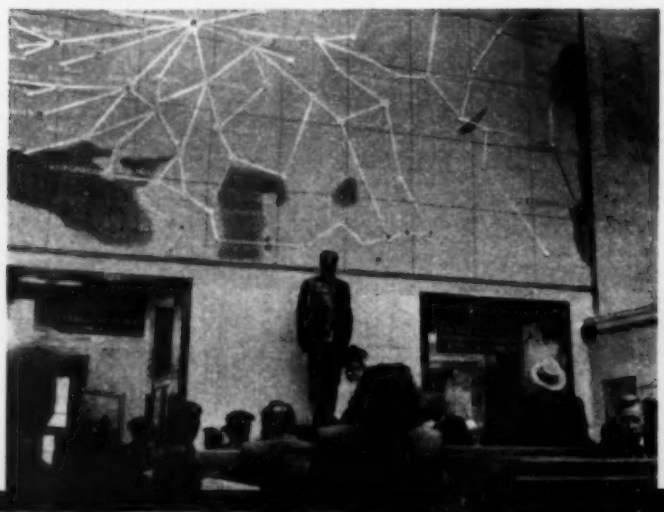
Linen head-rests are normally washed and ironed at the airport which does line maintenance. At Leningrad they were done by hand; 1,500 sets per day were being handled in this way.

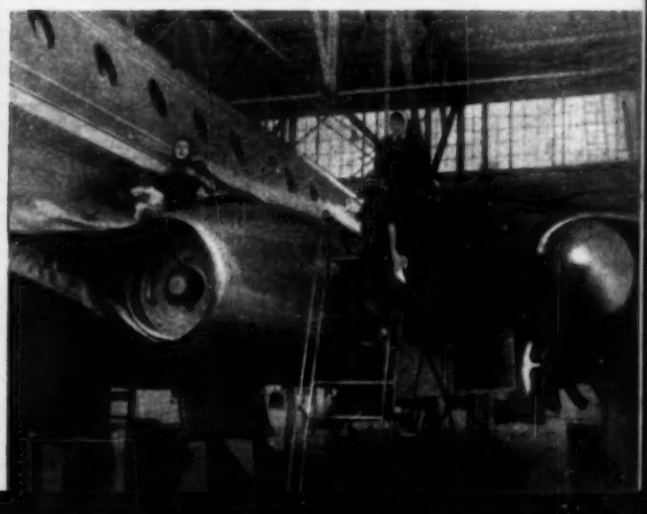
Airport organization varies to some degree throughout the country but each airport has more in common with the others than it has with Vnukovo. A typical example is Kiev. This airport is controlled by the fleet manager. Forty-four-year-old Ivan Mikhailovitch Pitomez has held the post since December 1956. He first joined Aeroflot in 1931 as an engine fitter. Now he manages the aircraft based on Kiev together with all the ground services (including line maintenance). He is required to fly a minimum number of hours as an aircraft commander, but his primary work is administration.

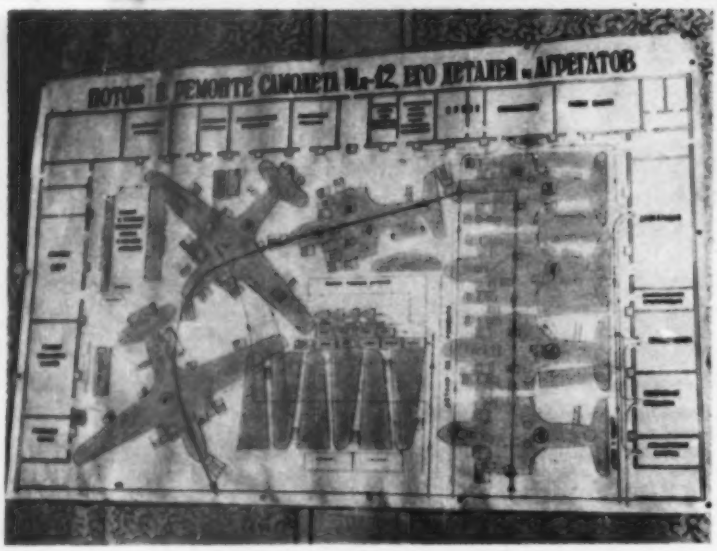
The reservations staff estimated that 1,500-1,600 passengers originate in the Kiev area each month. They thought, too, that the terminal would soon prove too small to handle the total traffic. When it was built in 1946—to replace a war-destroyed building—it was restricted in size, due to the need to provide housing as a first priority in the devastated Ukraine. It was not meant to be a terminal initially, but to hold all other airport services in a central headquarters.

Pitomez, like his colleagues in most other Republican centres, does not have a town terminal. The airport is eight miles from the city centre and served by public trolley-bus, a 25-minute

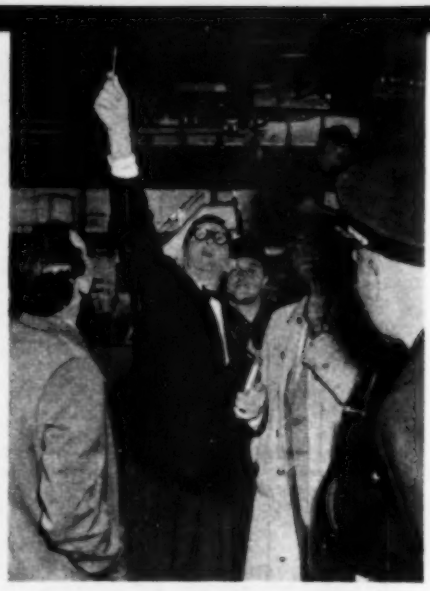
(Left) A statue of Stalin still dominates the main waiting room at Vnukovo, Moscow. Note the English translation of the direction sign. (Right) Cleaning a Tu-104 ("we found human hands are better than patent cleansers, too," they said) after line maintenance at Vnukovo.







A flow chart for Ilyushin major maintenance hangs in Superintendent Ferrenetz's office at the Kiev base.



Mr. John McGuire (works manager, B.E.A.'s engineering base at London Airport) — pointing — examines Tu-104 flaps at Vnukovo. Mr. J. W. Bishop (B.O.A.C. planning engineer) is at the left of the picture.

AEROFLOT . . .

journey. This is the same time taken to get to Vnukovo from the centre of Moscow, although that is a distance of 18 miles.

There is another airfield at Kiev, used for ground and aircrew training, but this does not come under the control of Pitomez. He explained that minor maintenance was normally carried on out-of-doors. In the summertime this presented no problem, but in the winter conditions the mechanics have to be issued with fur suits, while heated tents are erected around the engines (the tents are also used for protection from the sand when performing the same operations in the desert areas). The union agreements lay down minimum temperatures for out-door work; this particularly applies in Siberia, where human hands can stick to the chilled metal surfaces. There is little incidence of work stoppages in Kiev or Moscow, where the mean temperature is not normally below −25 C.

Kiev airport has 200 movements a day (100 in and 100 out) and, owing to its favourable geographical position, has an Ilyushin major maintenance base situated there which is controlled by an engineering superintendent and not by Pitomez.

Line Maintenance—which, like the base, looks after work from adjoining territories—has a primary task of servicing the 40 Il aircraft in the Kiev Fleet. This is done—in a way characteristic of the other bases we visited—with the following staff:—

Maintrol (including inspection records), with five persons in the section.

Radio Workshop, operated on a rotating shift 24 hour basis with five mechanics on each shift together with a shift leader.

Instruments—minor maintenance by five instrument makers working on single day-shift.

In addition to these men there are another 214, out of a grand total of 255 in Line Maintenance, who work rotating shifts to provide 24-hour cover in the hangars. These are broken down into the following categories: engineers and technicians, 140; fitters and lathe operators, 25; cleaners and labourers, 32; supervision, 17. The checks they have to perform are on this basis: Check 1, after 10 hours; Check 2, 50 hours; Check 3, 100 hours; Check 4, 200 hours. (However, the engines in the Ilyushins—identified to us as the Chezov 82, of 1,830 max. horsepower—are changed after 600 hours; their total life is 2,500 hours.)

We pointed out that these results were well below those of B.E.A. The engineers in reply said that they were working to fixed standards, but that they, nevertheless, expected to improve them in due course.

In all, Pitomez had a total working force of 1,200 at Kiev, including all the aircrew, but excluding the staff of the overhaul base. This latter is headed by a chief maintenance superintendent, Victor Antonowitch Ferrenetz, who sat beside a flow chart indicating the standard method of overhauling Il-12s and 14s, while he explained the aims of his base. Some 800 skilled and semi-skilled men and women are employed there in major repair and maintenance.

When an aircraft is received it is (in Ferrenetz's words) disassembled, cleaned and inspected; the schedule of work to be done is then drawn up. All removable equipment is taken to the inspection department before being released to the specialist ancillary-trades shops. The aircraft move through six stations on a belt principle; in the absence of an undercarriage an electric truck is used. They are then delivered to "technical control" for inspection and test-flying.

A complete turn-round takes 18 days for an Il-12 and the expenditure of 6,000-7,000 man hours. This is the equivalent of a U.K. Certificate of Airworthiness overhaul and takes place after 2,400 flying hours. It normally covers 18 months and gives a theoretical annual utilization of 1,600 flying hours.

The Kiev engineers insisted that the annual utilization figure was nearer to 2,000 hours, and the present target is to increase this to 2,500 by 1960. They also hope to increase engine life and get permission to lift the requirement from 600 to 1,000 hours between overhauls.

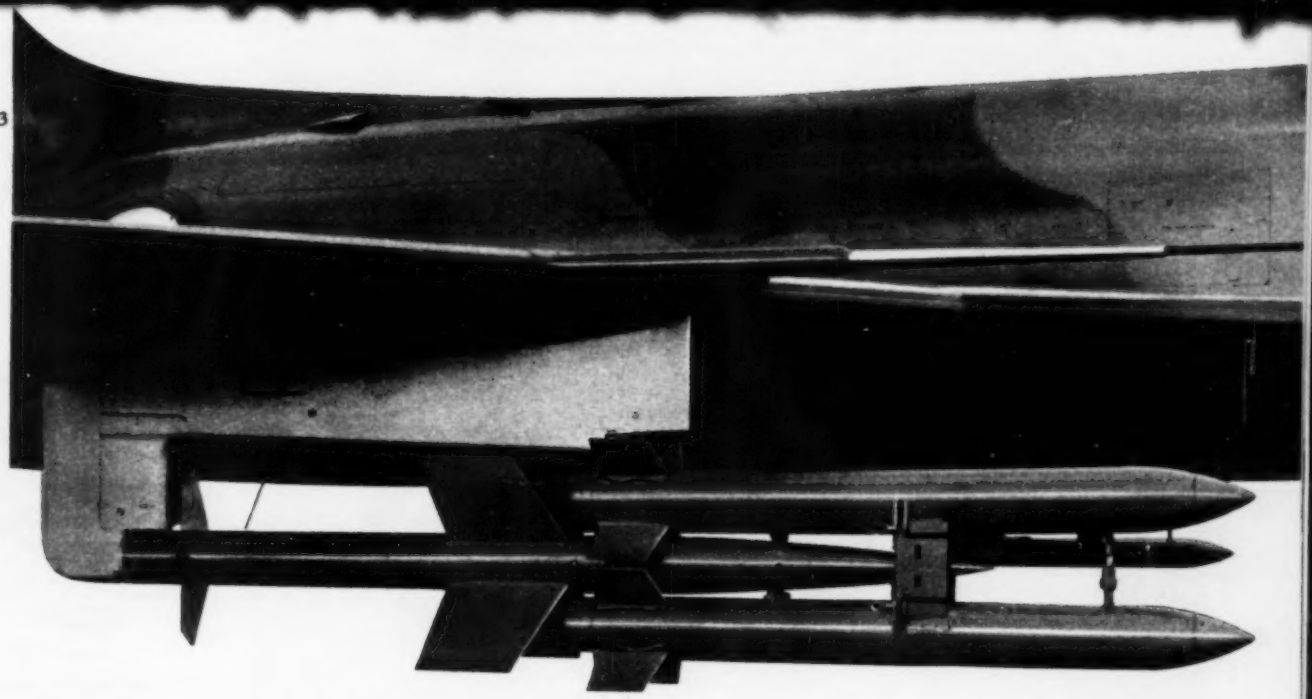
They reported that, with such a low overhaul life, engine failures were almost non-existent (although they were common until 1952; since then there had been one accident—an engine blew up and caused the total loss of an aircraft which had just left Stalingrad with a load of Norwegian women).

Engines have been overhauled at Kiev for over eight years, aircraft for only two years. The engine plant (with 120 workers) turns out 100 engines each month. The chief engine tester, a 38-year-old woman Varia Beinarovitch, explained that staff was "roughly on the basis of one man for each monthly engine with a single cylinder-bank and two men for double-bank engines." She had been eight years in this post following 11 years' previous service in which she had been promoted to be a checking forewoman.

In general the engine factory and hangars were unimpressive, in spite of the keenness of all concerned. There was a total absence of "progressive maintenance" and no planning department. In addition, the floor space was too small and every department was overcrowded, owing to the threefold increase in work-load over the past four years.

(To be concluded. World copyright reserved.)

Menu from the "flight companion" provided on certain internal routes.



FIREFLASH

FAIREY'S AIR-TO-AIR GUIDED WEAPON DESCRIBED AND ILLUSTRATED IN DETAIL

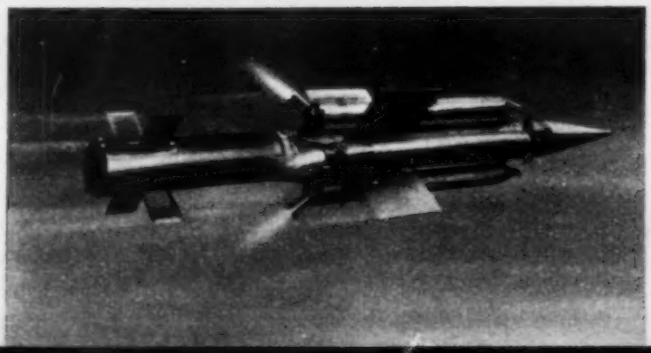
ALTHOUGH a photograph of the Fireflash missile was published (but could not permissibly be named as such) in *Flight* four years ago, and although there has been a trickle of information about the weapon since that time, it has not so far been possible to describe the background and engineering features of any guided weapon in such detail as in the article and drawings which follow.

Fireflash has been described as a relatively simple weapons system consisting of a number of missiles (four have been fitted under the wings of Swifts for example), a fighter aircraft fitted with a fixed-dish radar beam that is conically scanned, a gun-sight, a simple "permission-to-fire" computer, and various aircraft-to-missile services. A brain-child of the Fairey weapon division, this radar-beam-riding missile is the first training and indoctrination guided weapon to go into production for the Royal Air Force, and in combination with its Hunter carrier, it is also being offered for export sale. Proof of its success was forthcoming as long ago as 1953, when a drone Firefly target was destroyed off Aberporth by a Fireflash fitted with an explosive warhead and a proximity fuse. This sequence was filmed from the attacking aircraft and has been since publicly shown on several occasions, notably at the S.B.A.C. show last year.

Fairey's research division, from which the weapon division was evolved, was created in the closing stages of the last war. Its objectives were to pioneer British guided weapons and, in particular, to evolve a defence against Japanese suicide bombers. The missile developed for this purpose was called the Stooge; of similar shape to a small aircraft, with conventional wings and tail unit, it was propelled by solid-fuel rockets and was "twist and steer" command-controlled along the line of sight. Although the war was over by the time that Stooge was brought to fruition, it was quite advanced in conception and its success boded well for the future of further projects from the team by which it was developed.

On completion of the Stooge project, the division turned their attention to varied fields of research, some of which offered further experience in guided weapons engineering and techniques.

This S.T.V.1 separation test vehicle was used to develop the boost separation system for Fireflash and for ground-to-air missiles.



Development and research for a vertical-take-off Fairey Delta aircraft led to the design and development at Heston of pilotless, simplified flying scale models powered by liquid bi-fuel rockets. The hydrogen-peroxide and methanol hydrazine Beta motor was specially designed for the project by the R.A.E. Rocket Propulsion Department and developed by the Fairey team. A novel feature of these models was that the combustion chambers were made steerable in pitch and yaw to give adequate low-speed control. A Fairey autopilot was used to enable the models to execute complicated pre-set programmed manœuvres or to obey command guidance signals relayed by radio links.

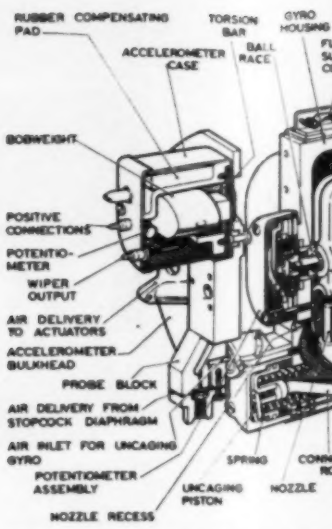
These pilotless models were used by the Fairey research division for investigation into various control and guidance problems. Provision was made for a progressive change from rocket control at low speeds to purely aerodynamic control as the speed increased. A peroxide steam-driven generator and battery pack provided electrical power for multi-channel telemetry equipment transmitting to ground receiving stations, and ground instrumentation —radar tracking gear, kine-theodolites, Doppler equipment and high-speed cameras—supplemented the data obtained in flight.

A number of successful trials were completed, both from a ship in Cardigan Bay and from Woomera, Australia. A special trials team led by Mr. L. W. Reeve, head of the division's trials department, went to Australia for this purpose. The first full-scale trials programme was carried out at the new range with the support of the special projects division of Fairey's Australian subsidiary.

When the Fairey Aviation Company first turned its thoughts towards a supersonic aircraft—to materialize so successfully as the Fairey Delta 2—parallel work began at Heston on the design of ground-launched pilotless models of an early swept-wing version of the design. When this work was eventually curtailed to make way for the Fireflash project, a good deal of basic development work had been completed. For example, the model required a new liquid bi-fuel rocket motor of higher thrust which was again developed by Fairey engineers in association with the R.A.E. and designated Beta 2. Among other design features of the models that were satisfactorily developed before the project was cancelled were a completely new sub-miniature, highly stable multi-channel telemetry transmitter and receiver, electrostatic clutch-control actuators, and a number of novel transducers. Simple drag-measuring models of this and other aircraft were manufactured and fired at Larkhill, Salisbury Plain.

A further activity of the weapon division during its early life, and one that was to influence Fireflash, was the design and manufacture of a boost-separation test vehicle, the S.T.V.1. About fifty of these elementary missile rounds were fired, and they provided valuable lessons which contributed to the design knowledge that was to go not only into Fireflash, but into the boost systems of all subsequent surface-to-air missiles.

Early in 1949 a small technical working party at Heston began the study of possible air-launched defensive guided-weapon



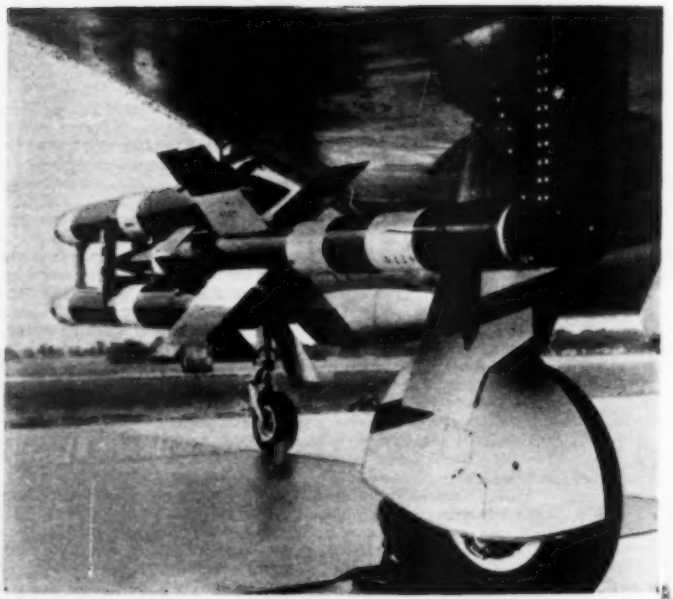
Sensing and control are performed in this ... speed-monitored rate gyros govern contro... gyro completes the trio; all rotate under ... of the lateral accelerom...

FIREFLASH . . .

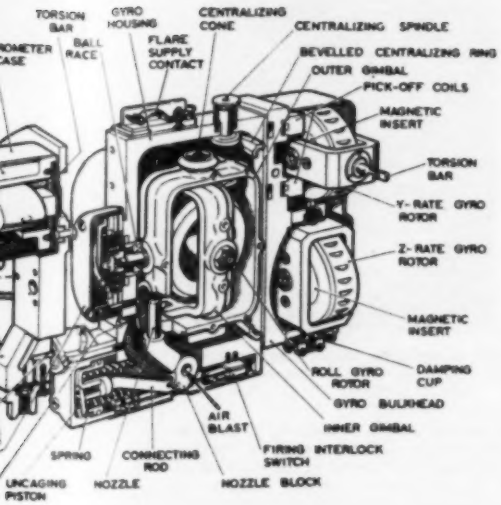
systems. This gave place to the more specific task of designing and developing Fireflash, first of the Fairey weapons. A development contract was placed in mid-1950, and the weapon satisfactorily completed Ministry of Supply acceptance trials early this year. It is now entering service with the R.A.F., and is offered as a worthy addition to the armoury of any first-class power.

The Fairey weapon division has been built up from the Heston working party to undertake the design and development of complete guided-weapon systems. Under the executive director, Mr. C. H. Chichester Smith, is an engineering organization that is tackling a variety of projects in addition to the one discussed here. Responsible to the executive director is the head of G.W. design and development, Mr. L. R. E. Appleton, and assisting him are two assistant chief engineers, respectively responsible for guidance and control (including telemetry, missile instrumentation, electronics, power packs, radar and aerials) and for system kinematics, accuracy and lethality, mechanical, structural and aerodynamic design, propulsive and explosive devices, aircraft installation and environmental testing.

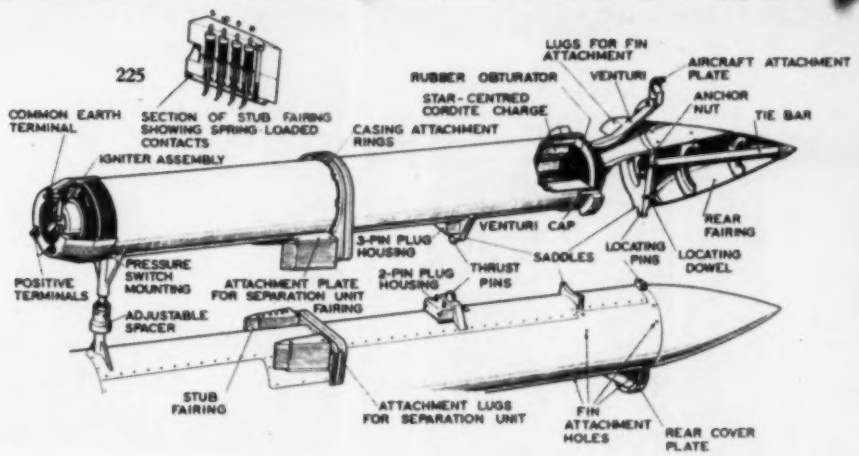
The two assistant chief engineers control the work of the design departments, which—under a technical office—carry out kinematics and aerodynamic design, stressing, weight control, airworthiness and type approval certification. Working in close conjunction with the technical office is an airframe and propulsion design department. Other departments with specific responsibilities for components of the weapon include the engineering development department already mentioned (where accumulated experience is put to good use in the design and development of



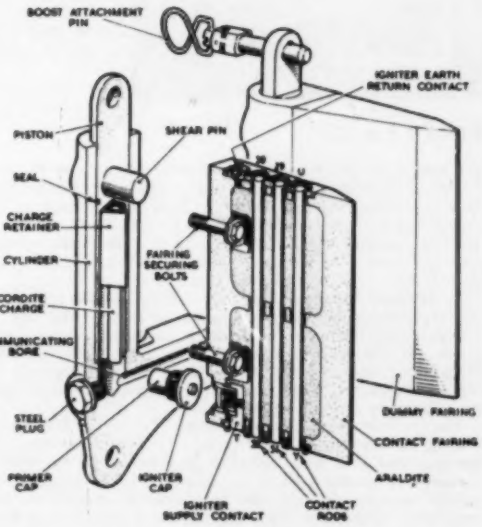
The three photographs on this page show the attachment of a Fireflash to its Hunter carrier. At the top, Hawker Aircraft personnel are raising the weapon into position by means of the special trolley and cradle; in the centre picture it is seen in position on its two simple attachments; and, right, the weapon adds an impression of lethality to the Hunter's trim lines. Note the nose radar.



re performed in this control instrument sub-assembly. The two gyros govern control in the pitch and yaw axes, and a roll rio; all rotate under inertia during the coasting phase. One the lateral accelerometers is not shown.



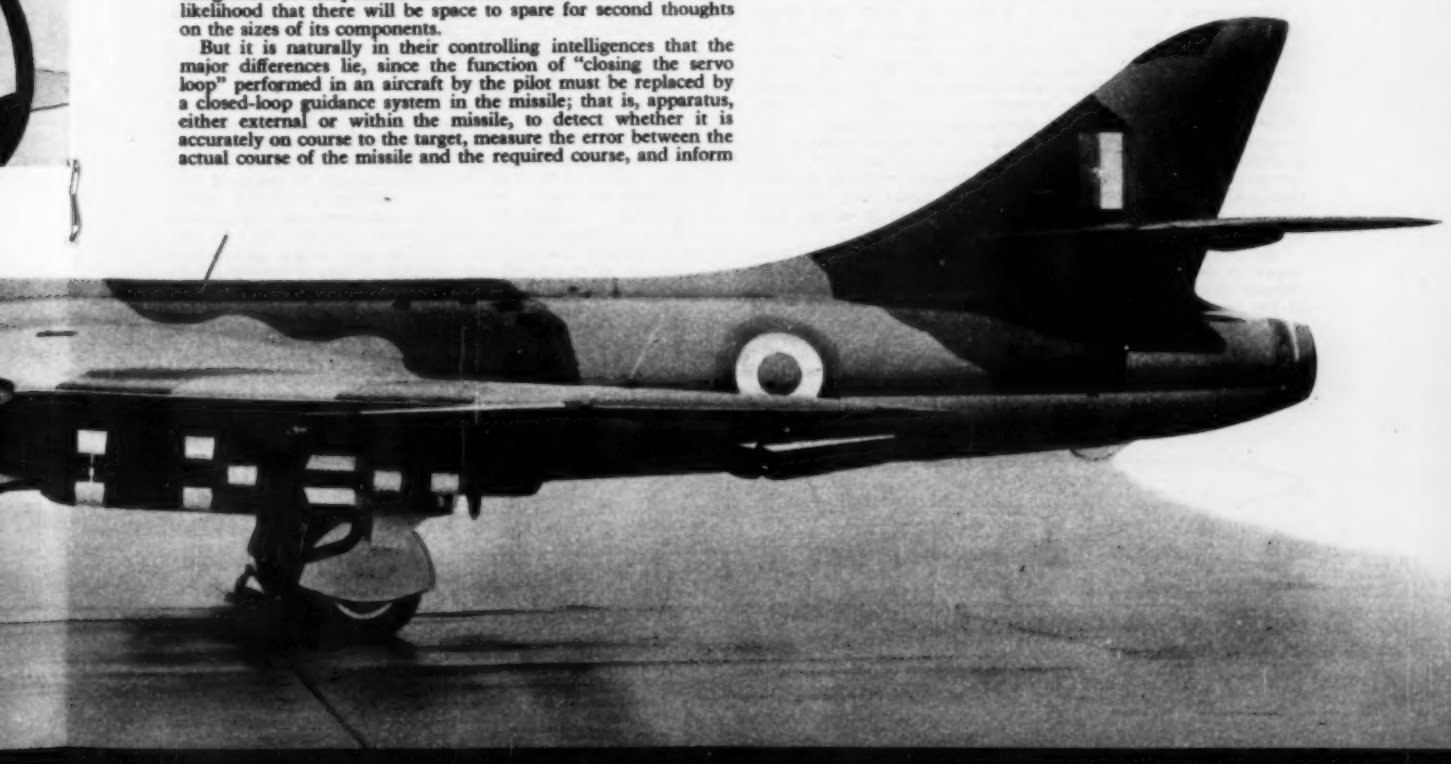
Booster separation is based upon a twin-piston breech block with a cordite charge. When both are "all burnt" a firing pulse is passed to an igniter and pressure builds up in the cylinder, thus shearing a pin and allowing the boosts to separate. The separation unit (below) is attached to the boosts with Pip pins.



production and service test gear) and a sub-divided control department. One of the two sections covers the missile guidance system and the other the ancillary guidance services. The head of this department is responsible for the missile as a servomechanism, for the design of missile instrumentation and for the design and operation of analogue computers and simulators. Within this organizational arrangement there is also a project engineer system; for each specific project an engineer is appointed to be responsible for technical co-ordination and progress. The Fireflash project engineer was Mr. P. H. Curnow.

The problems of guided weapons engineering, which at first sight may appear to have much in common with aircraft design, are in many respects quite different. Although it may be argued that both aircraft and missiles are fundamentally vehicles for conveying a load from one point to another as efficiendy as possible, there are important differences in their systems of control and the amount of integration between the various components that must be used. So stringent are the demands of missile engineering in this respect that failure to appreciate the space or functioning requirements of any part of the concept can only result in a severe loss of efficiency. While in an aircraft room can generally be found for one more essential "black box," the integration of components in a missile is such that there is little likelihood that there will be space to spare for second thoughts on the sizes of its components.

But it is naturally in their controlling intelligences that the major differences lie, since the function of "closing the servo loop" performed in an aircraft by the pilot must be replaced by a closed-loop guidance system in the missile; that is, apparatus, either external or within the missile, to detect whether it is accurately on course to the target, measure the error between the actual course of the missile and the required course, and inform



This sequence, filmed from the wing of a pilotless Firefly target shows an unfuzed Fireflash—just discernible—about to strike the tailwheel and (right) the tailwheel carried away.

(Left) Twelve showerheads are directed at exposed electrical components to test the insulation resistance in tropical rain.

FIREFLASH . . .

the missile of this error. The guidance system thus gives commands to the control system to reduce the error between the actual course and the required course. (This measurement of the error between actual and desired values of quantities, and the feeding back of demand signals which tend to reduce the error, is the defined function of a servomechanism. The guided weapon can be regarded as a complicated example.)

In carrying out the commands of the guidance system the control equipment operates upon the airframe, and the velocity changes are monitored by sensing instruments (accelerometers, gyros, etc.) in feed-back loops. To achieve the desired flight programme the internal loops must be so designed that the required manœuvres can be carried out accurately and stably with the minimum amount of overshoot.

The primary design requirement of a weapon system is that it shall be operationally effective. It should be as accurate as the warhead and fuze lethality requires it to be, even in the presence of enemy counter-measures; and it should be reliable, readily serviceable and safe in whatever theatre of war it is employed. Subject to these conditions, it should be as simple and cheap as possible requiring the minimum of training of personnel for its effective use and maintenance. Pre-flight testing must be kept to the minimum practicable, and repairs should be effected by component replacement after simple fault-diagnosis.

Recognition of these principles is the design philosophy which has been adopted at Heston—to design for production and for operational use from the inception of the project. The weapon may well pass through a number of prototype phases, but at each phase the current prototype is a missile which, in the current state of knowledge, could be an operational weapon. The trials philosophy follows the design philosophy. Each aspect of the weapon system is thoroughly tested in its environment in the laboratory before trials begin. Proving and development of the system components follow, by firing degraded prototype missiles incorporating only the system components under test. As trials proceed, the fired missiles approach more closely to the fully integrated prototype.

This system has many obvious advantages. It ensures that at all stages in design the maximum effort is being directed at the ultimate objective. So many of the required features of the design of the system components are determined by interactions with other components, that component design cannot be allowed to proceed in water-tight compartments. This progressive integration ensures that no time and effort are wasted in the solution of irrelevant problems, and it ensures a copious supply of standardized missiles for trials use—in the Fireflash development and acceptance programme hundreds of missiles have been fired.

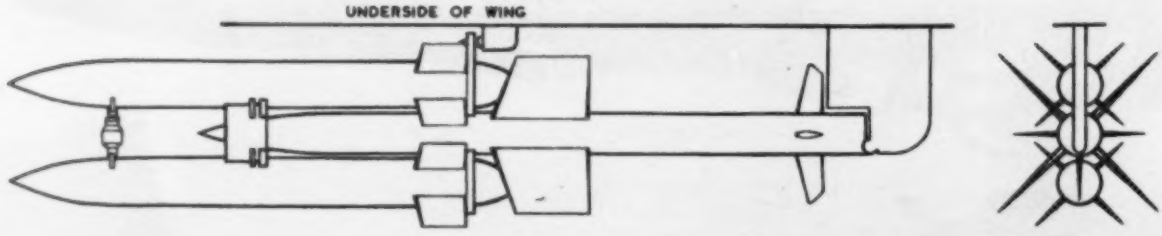
The gap between the designer and the trials engineer is bridged during research and development by the engineering development department to whom are delivered airframes, instruments and electronic sub-assemblies. This group assemble and test the missiles, fit them with telemetry equipment and calibrate them before they are fired.

Great emphasis must be placed in the design stage on the need for reliability, which can be achieved only by adequate recognition of its importance, and a reliability group operates at Heston as a design advisory service. It collects and collates component and overall reliability data during manufacture, laboratory testing and trials—not to assess the reliability of the missile but to improve it by feeding back information during development. Responsibility for the attainment of a reliable component remains in the hands of the designer, supported by a manufacturing facility adequately monitored by quality control.

Unreliability arises from a component, as designed, being unable to sustain consistently the extreme environmental stresses to which it may be subject during its operational life. These stresses may arise from steady accelerations, shock and vibrations experienced during its active missile life, in transport, from adverse climatic and atmospheric conditions (temperature, pressure, humidity, dust, contamination, etc.), from storage, or just from age. It is the practice at Heston to interpret the weapon specification in terms of these adverse operational stresses, and to draw up a comprehensive programme of environmental type-testing for specimens of each component. During the development phase each specimen is subjected to a shortened version of this test programme in order that the reliability of the component shall be adequate for trials use, and that it shall later have a reasonable chance of meeting the type approval requirements.

In support of this philosophy a comprehensive environmental test laboratory has been built up at Heston. Two stratospheric chambers each of 8 cu ft capacity are available, covering a temperature range of −75 deg C to +85 deg C, humidity up to 100 per cent at 85 deg. C. and pressures equivalent to operating altitude. Three further six cu ft unpressurized chambers can be used in the temperature range −50 deg C to +85 deg C. A large chamber (18ft × 5ft 6in × 4ft 6in), can similarly be operated over the temperature range −50 deg C to +86 deg C with full control of humidity. Tropical life cycling chambers and mycological chambers for fungus and bacterial growth up to 9ft × 4ft × 4ft size, a sand and dust chamber and a driving rain cabinet (shown in a photograph on this page) are available to take a complete fully functioning missile. Other climatic facilities include ultra-violet radiation equipment, and water, acid, alkaline and salt-spray

Fireflash installation. The overall length of the missile and boost combination is 111.75in; missile wingspan, 28.11in; control surface span, 17.97in; boost centres, 12.26in; boost motor diameters, 6in.



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MINISTER OF DEFENCE, APRIL 16TH 1957

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To a young man ambitious to fly, and with the ability to lead others, the R.A.F. offers a fine and useful career. Men of high quality are required to fly the V-bombers, fighters and high-speed reconnaissance and transport aircraft. Even for those functions where unmanned missiles will in time give the answer, manned aircraft must continue in service for a number of years yet. Moreover, manned aircraft will *always* be needed for those functions to which the human brain in the air is indispensable. And, whatever new instruments of air power are evolved, the R.A.F. will always need men of initiative who have been trained to master the problems of the air in the air. For such men this is a time of opportunity. Not only can they fulfil their ambition to fly for as long as they serve. They will have the chance of a full and satisfying career. Aircrew do much more than fly. They are often seconded for other important work in Britain and abroad. Variety is more than ever the essence of a career in the R.A.F. Whatever a man becomes—pilot, navigator, air electronics officer—there is no limit to what he may achieve. Quality counts. There is, and always will be, room for good men.

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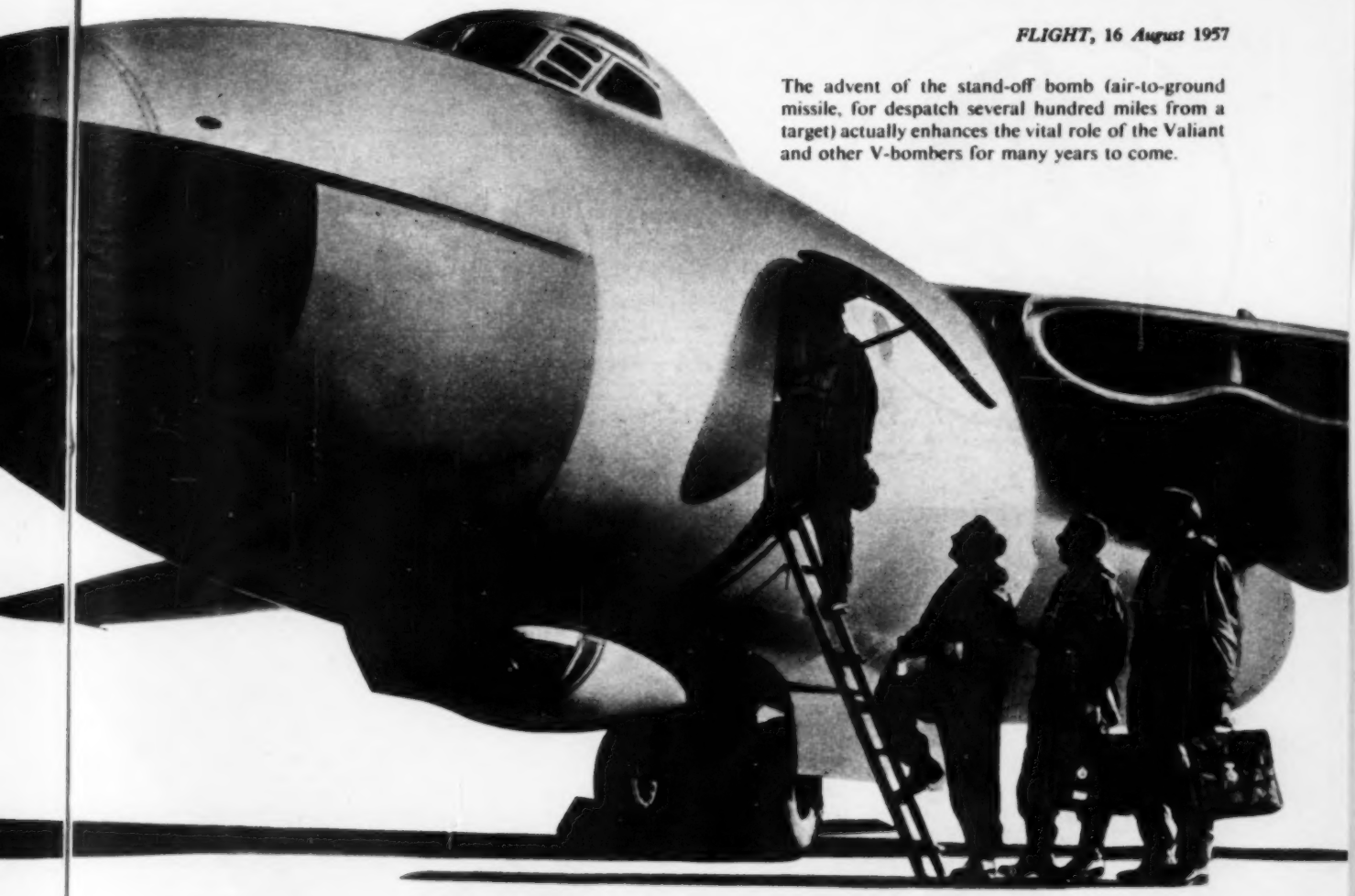

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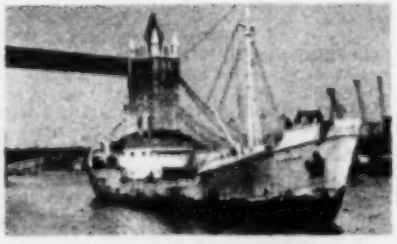
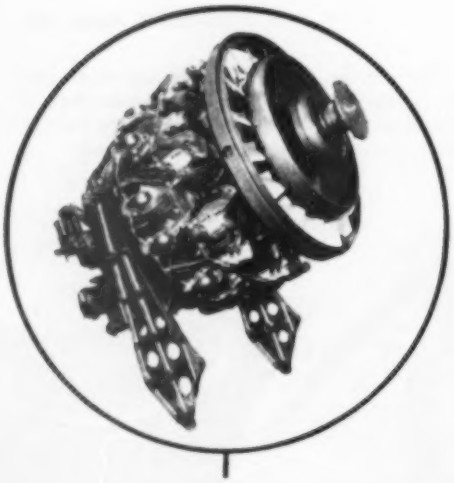
RESPONSIBILITY. To fly with the R.A.F. is to work with the most dependable men in the world, confident and well qualified for each of the many calls on their skill and initiative.



ADVENTURE. R.A.F. personnel were aboard the *M.V. Theron* as she returned with the advance party from the Commonwealth Trans-Antarctic Expedition, on the 23rd March this year.

The Royal Air Force *Flying . . . and a career*



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The prototype Swift 7 with a Fireflash under each wing. A Swift squadron is being equipped with these missiles.

FIREFLASH . . .

booths. Vibration equipment includes a 5 kW moving-coil exciter, many 1 kW exciters, scanning and control equipment, calibrators, and vibration transducers of various patterns. Bump machines, impact testers and centrifuges are also available in various capacities. These facilities supplement the usual structural, pneumatic and hydraulic test equipment at Heston as well as the more specialized test equipment used by the department.

The Fireflash missile consists of a central unmotored cruciform winged dart which is boosted to maximum speed by two solid-fuel rocket motors attached externally to its forward end. During the boost phase the unguided missile is spun by offset venturis to minimize dispersion caused by asymmetric thrust. When the motors are "all burnt" an explosive separation device throws off the spent motor cases laterally, leaving the dart to coast towards the target. The four "rudders," indexed at 45 deg to the wings, unlock at separation and the missile is roll-stabilized by aileron-wise rudder deflections to a datum established at launching. As soon as the roll error is reduced to within specified limits guidance commands are switched to the control blocks. The missile position relative to the axis of the radar beam, measured in polar co-ordinates, is interpreted as Cartesian linear errors resolved in the two control planes. The pneumatic actuators, served by electro-pneumatic relay valves, apply rudder deflections which tend to reduce the linear errors and to return the missile towards the beam-axis. During this gathering phase the maximum lateral acceleration is limited by clamping diodes. The missile then rides along the beam axis, following any beam motion which may occur.

The accuracy of the weapon then depends upon the accuracy with which the beam is laid on to the target. In the daylight fair-weather rôle the pilot of the firing aircraft tracks the target by keeping its image at the centre of his gun-sight graticule. The radar beam axis is accurately harmonized relative to the gun-sight, so that the only significant guidance error introduced is that due to aim-wander of the pilot-aircraft combination in tracking the target, which may be taking evasive action.

Development trials were carried out by the Fairey Aviation Company from installations on suitably modified Meteor 7 and Meteor N.F.11 aircraft, and successful beam-riding has been demonstrated from a two-weapon installation in a Hunter. Royal Air Force trials are being made with further installations in a squadron of Swift 7s. Installation in other aircraft is stated to be "practicable and simple."

The mechanical design is such that the weapon conveniently breaks down into the rear cylindrical portion of the dart—on which the wings and rudders are mounted—containing all the control, guidance and power supply equipment, and an explosive assembly comprising the two motors, their separation gear, the warhead and its fuze. This forward assembly is offered up to the rear dart after the latter has been fully tested on an O.A.T.S.—operational airfield test set.

Structurally the rear body consists of an extruded and forged magnesium-zirconium alloy tube, into which slides a two-rail chassis carrying the internal equipment. The wings and rudders are aluminium forgings machined only over their bosses. The cruciform wings are swept back on their leading edges, have square-cut tips and are mounted to the tubular shell by flanges and countersunk bolts. Small controlling rudders are screwed and spigotted to cylindrical output shafts mounted on ball races in the actuator assembly block. Air, controlled by four electro-pneumatic relay valves (giving proportional position control), and ducted from the high-pressure storage bottle, is fed to either of a pair of pistons running in cylinders formed in the block. The rams of the selected piston of the pair actuate the rudder either to the right or to the left through links, after the control surfaces have been unlocked; there is a solenoid-operated release valve controlling—through a central operating piston and spring-loaded locking linkage—locks on the rudder drive shafts.

The two booster motors are attached to each other by a "U"-shaped separation unit, and location fittings on the motors mate with holes in the warhead case. The fuze is located forward of the warhead to which it is attached, and forward of this, in the extreme nose, is a spacer device which pre-tensions the assembly to make it rigid.

The separation gear comprises a twin piston-cylinder breech-block containing 0.06 lb of cordite. The pistons, attached to one motor, are held by shear pins in the cylinders attached to the other motor. A single igniter in the base of the unit flashes to the two separate charges in the two cylinders. A pressure switch, which arms on build-up of pressure in the rocket tube and fires when the pressure subsequently falls to 250 lb/sq in, is located in the nose of each rocket motor; these are series-connected so that when both motors are "all burnt" a firing pulse is passed to the igniter. The pressure in the cylinders builds up until the shear pins fail and the motors then separate relative to each other and to the dart. The motors are fitted with stabilizing fins to prevent their toppling after separation and so decelerating fast enough to endanger the firing aircraft.

Forward of the front bulkhead is the warhead, into which is fitted, when test rounds are fired, a compact telemetry unit. All the equipment behind the bulkhead is concerned with guidance and control and is installed between chassis rails to which covers are fixed to sheathe the telemetry wiring, fuzing and firing circuits. At the front is a forged light alloy air bottle containing air at 3,000 lb/sq in for all the pneumatic supplies (in particular the aerodynamic controls), an internal reducing valve and an electro-pneumatic stopcock.

Behind this source of stored energy are the lateral accelerometers measuring in the two control planes, and the air-blown gyros in another small assembly. The gyros derive their continuous power source from air piped from the aircraft by which they are carried; after the missile has been released and during the glide the gyros coast on their inertia. Mounted transversely in the gyro assembly are two speed-monitored rate gyros governing the "x" and "y" control axes and a gimbal-suspended roll-displacement gyro rotating in the fore-and-aft plane.

The electronic heart of the weapon, also concerned with its guidance, forms the remainder of the block of components. These are carried in an electronic sub-chassis. The electronic power supply pack is mounted adjacent to the electronic gear.

Behind the electronic section is the servo motor comprising—as described earlier—the actuator and its four pairs of piston-cylinder units and, at the extreme rear, the receiver aerial assembly and rear bulkhead. All of the components and systems are designed and developed by Fairey, with "significant" help which they received from the Plessey Company (who contributed to the production of the receivers) and E. K. Cole, Ltd., who were responsible for the radar beam set installed in the carrier aircraft. As Fireflash is a coasting missile, propelled only during its acceleration period, guidance problems are eased by the lack of rocket-flame ionization, and the aerial system can be advantageously located in the tail of the dart.

The aircraft industry—and the taxpayer—were forced to recognize long ago that the development of a guided missile was no quick and easy business; and Fairey's weapon division will be remembered for their success in producing the first missile to go into R.A.F. service. Fireflash was developed under a Ministry of Supply contract, and the credit accorded to Fairey's design and production teams must be extended to include Gloster, A.W.A., Hawker, Air Service Training and Vickers Supermarine who, as aircraft contractors, co-operated willingly to expedite the installation of the weapon system in aircraft for trials and operational use. The Ministry's technical establishments—R.A.E. at Farnborough and at Westcott, R.R.E. at Malvern and A.R.D.E. at Fort Halstead and at its firing ranges—also gave valuable help and technical support in the painstaking research and development needed to create a production weapon system.

NAVAL COMINGS AND GOINGS

"Flight" photograph

A Fleet Air Arm Dragonfly alights on a stern-platform aboard H.M.S. "Grenville." The aircraft gave air-sea rescue demonstrations during Navy Days held at Chatham over the August Bank Holiday weekend.

(Right) Seen from the island of H.M.S. "Ark Royal" during recent deck-landing trials, a D.H. Sea Vixen is launched by the steam catapult while deck crew protect their ears and a Supermarine Scimitar, also undergoing trials, stands by; (below) a closer look at the Sea Vixen.

Leaves from a Log-book

Part 3: Out of the Service

By PATRICK JOHNSON

THIS is the concluding instalment of the reminiscences of W. E. P. Johnson, A.F.C., C.P.A., A.F.R.Ae.S. The previous two (August 2 and 9) dealt with his days in the Royal Air Force. Here he recalls some of his experiences as a civilian pilot in the nineteen thirties, leading up to the time when—shortly after the outbreak of World War 2—he joined Sir Frank Whittle's team in the pioneer days of jet propulsion.

WHEN I left the Royal Air Force in 1932 I had about 2,600 hours in my log-book. In some ways I was very sad to leave; but I don't think I was cut out to be anything but an instructor, and one could not go on just doing that.

I had, of course, a civilian licence, so I went back to my professional job in the City, determined to keep my hand in. Flying was quite expensive, so I made it known that I was available as an amateur free-lance pilot, willing to do odd jobs. One of the most interesting that eventually came my way was to fly new types for the purpose of writing about them for an aviation journal, and in that capacity I frequently used to visit firms to put their latest products through a more or less routine series of tests. This brought useful new experience, and I acquired about twenty more types in my log-book, bringing the total to somewhere around 120.

This practice, incidentally, gave me my first experience with flying-boats and seaplanes. I had always been anxious to break into what was then known as "the trade union"—the relatively small number of flying-boat pilots who were, bless them, rather apt to make a mystery of their craft. Perhaps because I was a yachtsman, I could never see any mystery in it; but it did take me a little time to get used to the hardness of water. At alighting speed, water seems to be a lot harder than land, and the banging and clattering of landing on it, without nice springy wheels and tyres to take the impact, was at first rather unnerving.

As a free-lance pilot, I had other diversions, too; I delivered an aeroplane to Madrid for the then Spanish Government. It had Spanish military markings, the second cockpit was full of spare parts, and the period was Christmas week. The idea was that the delivery might entail some dirty-weather flying, and what reputation I had was in that direction.

I took off, all set to get to Madrid in a couple of days, but forgot my foreign money, so had to turn back. Then, just south of Caterham, I got into such a thick fog that I had to land in a field and wait for hours. When I took off again, half the accessories fell out of the rear cockpit—I left them. The result of the first day's flying from London was that I reached Lympne! Clearing Customs at dawn next day, I asked if the parachute bag containing all the formal documents and my passport was safely in the locker and was told that they were. In due course I taxied up to the visitors' hangar at Le Bourget, where I was well known, to be told that all the documents, including those which explained the Spanish military markings, were still at Lympne. I found myself under arrest, though I was allowed to stay in the nearest hotel. As it was a Saturday, no trans-Channel aircraft was expected until Monday. I managed some telephoning and got the papers collected from Lympne and taken to Croydon, to be sent by the first Imperial Airways Service on the Monday.

Railway Aeronautics

This worked satisfactorily, but then began a race, for I had to get the aeroplane to Madrid by the Tuesday night and the weather was filthy. I flew that afternoon as far as I could in daylight (I had no night-flying equipment), took off again, and on Tuesday landed around lunchtime at Biarritz. The aerodrome there was looked after by an ancient who told me it was impossible to cross the Pyrenees, because his corns hurt, or he couldn't see a certain village, or something.

The map showed a railway running along the Spanish coast, and the fourth turning to the right went to a town called Vitoria, and thence to Burgos and Madrid, so I set off. Finding that the fourth to the left turned into a valley, I flew above the railway under low cloud, over a short tunnel, and then came to Vitoria, where the railway came to a dead end. There was nothing for it but to turn back to Biarritz; but just then I noticed on the hillside a puff of white steam, which on closer inspection proved to come from a tunnel ventilator. There was obviously a junction in the tunnel, and the branch of the railway I needed climbed up inside the hill very nearly to a mountain pass. The only helpful thing in sight was a line of telegraph poles, possibly tracing the tunnel. I followed them up the mountain and, sure enough, the railway emerged just before a narrow pass. I flew through it into sunshine.

From there to Burgos was easy, though the countryside was grim, snowbound and utterly deserted. I have forgotten the distance, but it seemed a very long way. When I got to Burgos, I couldn't see the aerodrome, but I did see a large shallow lake, and closer investigation showed it to be in fact the aerodrome. By now I had very little petrol, so I came in very slowly, as close to the buildings as I could, and landed with a terrific splash. The flood-water was about four inches deep—quite enough to be a crash risk if this aircraft had not been a very easy one to land.

A solitary figure in uniform emerged. I knew one word of Spanish—*gazolina*; so I pointed to the petrol tank, said "*gazolina!*" as imperiously as I could, and fled behind the nearest hangar, as one pursued by nature. After a decent interval I peeped round the corner, to see the chap filling the tank. When he came down off the ladder I re-emerged, switched on, swung the propeller, and was off before he could even ask me for a receipt. I expect the Spanish Air Force is still trying to account for the deficiency.

Now for Madrid. It was freezing; my shoes were full of water and I had an ordinary civilian overcoat with a suit underneath. For all that, it was a lovely evening, with a sunset showing behind a nasty-looking reef of mountainous hills. I flew on into the dusk. By the time it was dark I found myself heading straight for a splash of lights, which was Madrid. I had been instructed to land and clear Customs at the civil airport, which lay to the left of the city. I veered that way but could see no lights identifiable as an airport, though I could dimly discern—it was now pitch dark—some airport-like buildings, visible in the reflection from their own lighting; and in the glow they gave I landed safely.

It was indeed my destination, but everything was shut down, and nobody wanted me because of a New Year's Eve party. I ought, they said, to be at the military airport the other side of Madrid. I would find it by seeing the red lights on their immense radio masts, the tallest in the world. Taking off again, I flew across Madrid into utter darkness. Not a red light in sight and only about twenty minutes of petrol left. I was, of course, a fool to be there, but I had four hours left in which to deliver that aeroplane, and deliver it I would.

In on the Beam

Just as I was about to go back to the civil airport, I saw a couple of cars, with headlights, arrange themselves with their lamp beams converging, then another pair, and another. This looked good to me, so I went down and landed on the illuminated streak they provided. Some quick-witted Spanish officer, whom I never even met, had made this effective improvization when he heard me circling. I was down, the aircraft was delivered, and that was that. It took me almost all night to get warm again. I was so cold I could hardly raise a drink to my lips.

The next day I had to go out to the base to demonstrate my travel-stained aeroplane to an official reception committee. This I did, and threw it about with great vigour for about half an hour. No sooner had I landed than the agent took me aside and asked if I would do it again. I was pretty fed up, but nevertheless took off, and this time I really gave them the works, including some crazy flying actually on the aerodrome, in the course of which I had the pleasure of seeing most of reception committee fall flat on their faces.

Driving back into Madrid afterwards, the agent told me that some of the senior officers believed that I must have pulled the aeroplane to bits in the first demonstration, and could not possibly have risked a second one without completely inspecting and re-rigging it. It was gratifying to be able to be so convincing about a British product, and I believe that a fair number of similar aircraft were afterwards ordered.

Later on, I carried out more demonstrations for the Portuguese Government. For various reasons, it was inexpedient to fly out, so my aeroplane, with its wings folded, was built into an enormous crate, and this was loaded on to a small Portuguese ship in London. It was the biggest crate the Port of London had ever handled, and it had to go across the deck, projecting over the sides of the vessel. It completely obstructed all forward view from the bridge and I shall never forget seeing the London River pilot pacing a crate instead of the bridge. At Lisbon, the crate was too big to pass through the streets, so it was put on to a barge and floated down the river to a seaplane base, and lifted ashore by a big crane. The end of the crate was knocked out, and the aeroplane emerged like a butterfly from a chrysalis. The next problem was to get it away; but fortunately the seaplane base had a football pitch, and although this was surrounded by telephone wires I managed to take off with just a couple of gallons of petrol, and flew to an aerodrome not far away.

[*continued overleaf*

LEAVES FROM A LOG-BOOK . . .

The next six weeks were riotous. An ex-R.A.F. colleague, Christopher Clarkson, was there, with a competing aeroplane, and also a delightful American, Gordon Mountz, with an American competitor. We all stayed in the same hotel, and within a few hours were firm friends. It was evident that the Portuguese authorities would require many demonstrations, and also evident that it would be expedient to take up a number of officers and their wives and families, purely in the interests of salesmanship, so we divided ourselves into watches.

This worked very well. Any one of us was apt to fly any of the three aircraft and, despite the element of commercial competition, three aircraft were demonstrated to full advantage. We finished up our stay by doing an exhibition in formation over the centre of Lisbon, on a Sunday, when people were in the streets. In the course of this one of us flew up the main street inverted, with his two companions in close formation. It was later reported in the Press that we had done this under the tram-wires; but that was, perhaps, a slight exaggeration.

I had to land back again on the football pitch, which was a lot trickier than taking off. Before going over to it I practically emptied the tank of the aircraft and, having no brakes, deflated the tyres. Then, by dint of a nice breeze, and a good deal of care, I got down and actually stopped before the half-way line. I think it was probably this, more than all the official demonstrations, that sold half a dozen aeroplanes to the Portuguese; and in those days a contract for six aeroplanes was quite a contract.

The Portugal trip taught me a great deal about a very obvious fact of salesmanship so important today—that vaunting the merits of goods at home is a very different thing from selling them abroad. Necessity was borne in on me of getting the buyer's angle, and of spotting the small things that would sell one article in preference to another. One thing that "sold" the aeroplane was that I had changed the instruments from the British system of indication to the Continental. Foreign pilots who flew it immediately felt familiar, and were predisposed to like it.

For the next few years I did little flying. I was busy in Chancery Lane, but I was much in contact with aviation and I was still on the Air Force Reserve, which involved flying for twelve hours a year. During this period I flew some further types, won some races and competitions, and generally just treated flying as a hobby.

By 1938 things had begun to look different, so I got a job as a part-time instructor in a Reserve School. This meant teaching new boys on Tiger Moths one evening a week and on Sundays. I was doing this when war broke out and we were mobilized.

The winter went peacefully, if slowly, and in the following February my career took a new turn. I learned that I was to be posted to Frank (now Sir Frank) Whittle and his embryo company, Power Jets. We had actually become acquainted in 1929, ten years earlier, when he was a pupil at the Central Flying School and I was instructing there. It was in those earlier days that he had conceived jet propulsion. We had become friends and, indeed, we had met frequently during the intervening period.

Frank had procured my attachment to his little team and today it is a curious reflection that although I was then intended to be a test pilot for the purpose of flying the first jet, I have never yet flown a jet. I rapidly found myself immersed in a lot of miscellaneous duties, each of which was more essential at its time than flying. It was, of course, a most dramatic, secretive, and at times frustrating, business. We were not only developing a new propulsion system, but simultaneously developing the engine itself from scratch, and closely collaborating with Glosters in the building of a totally original aeroplane. We had to fight poverty financially, opposition technically, and jealousy politically; and had it not been for the doggedness of Whittle and the staunchness of Dudley Williams—who is now an M.P.—and Coll Tinling, both ex-R.A.F. officers, we should have had no success. I believe that although jet propulsion would have come in, it would not have come in first in Britain. We were ahead, but only marginally, of the Germans.

Both A. Cdre Sir Frank Whittle and Patrick Johnson were persuaded to appear in the documentary film "Wonder Jet" (from which this is a still) produced by the Central Office of Information in 1950.

Since I am supposed to be recalling my own flying experiences, it would be out of place to try to talk about jet development. I will say, however, that the active flying experience of my three colleagues and my own gave our efforts a realism and practicability which would not otherwise have been possible. For example, I used my streamer methods of watching airflows to good effect in teaching us something about the behaviour of the airflow inside various parts of a jet engine, which I was able to make up out of transparent material.

In working with Glosters, I was able to talk with other pilots on reasonably level terms, so that we had an excellent understanding, which was duly reflected in a marvellous aeroplane.

I was primarily responsible for the day-to-day collaboration between Power Jets and Glosters. The incidents surrounding the first trials of the Gloster E.28, with our first engine in it, were incredibly dramatic, and at times humorous, but that is another story.

Thumbing through the pages of my flying log-books, each one reminds me of incidents—humorous, tragic, technically or historically interesting—all of which convey something of the spirit which kept flying alive between the two wars, and which, as it proved, gave birth to the generation of pilots who, by their skill and valour, saved Britain and civilization.

CABLE-TENSION COMPENSATOR

This neat tension compensator for use in single-line cable systems provides immediate response to operating forces and maintains a constant rig-load when the system is stationary. Developed by the Pacific Scientific Company, of Los Angeles, it is intended for all applications accomplished by tension cable.

LONDON AIRPORT—STEREOSCOPICALLY

SOME remarkable pictures of London Airport and its aircraft have been added to the series of "View-Master" stereoscopic colour photographs well known in America and now being produced in this country also—by View-Master (England), Ltd., 16-19 Eastcastle Street, London, W.1. B.O.A.C., B.E.A. and the M.T.C.A. co-operated with the photographer.

The views—both exterior and interior, the latter including scenes in the various control departments—are superb examples of colour photography by any standards. When seen as stereoscopic transparencies, in a plastic viewer of little more than pocket size, they are quite startling in their solidity and realism. They are arranged round the periphery of a small disc, which is rotated in the viewer by a trigger. Each disc contains seven views, and there are four discs in the London Airport set.

Another set, photographed in America, consists of scenes on board an aircraft carrier. A wide variety of subjects comprise the full View-Master library. Viewers, now in the shops, cost 29s, and the discs are 5s each.

Training the Naval Air Engineer

The R.N. Engineering College and its Work

By A. CECIL HAMPSHIRE

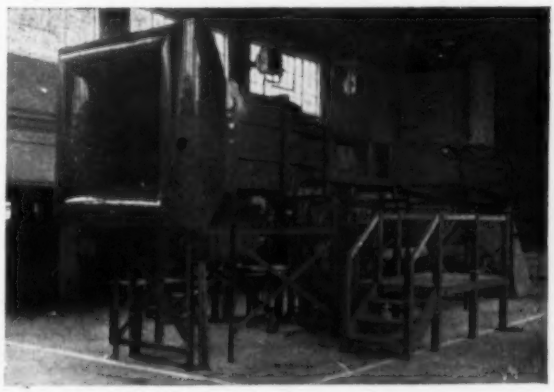
ON the brow of a tree-clad hill overlooking Plymouth Sound a handsome four-storied building is taking shape. It is the new accommodation block of the Royal Naval Engineering College, Manadon. Behind lie the completed workshops, instructional buildings and hangars which form the core of the Navy's technical university of the future. The College is commanded by Capt. Sir John Walsham, O.B.E., R.N.

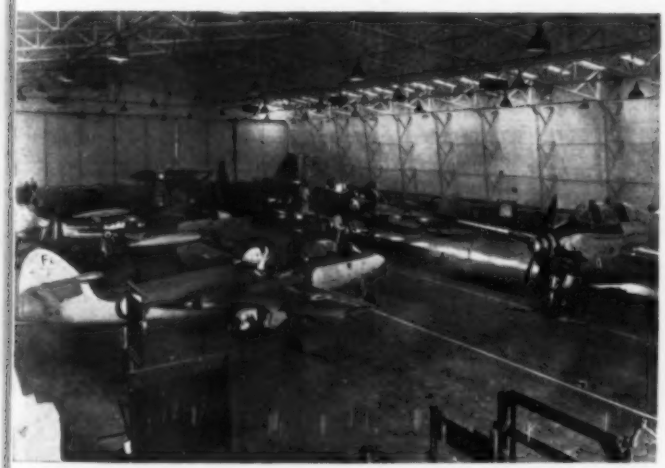
After their initial Dartmouth entry course and sea training the Navy's budding engineer officers come to Manadon to undergo their professional training. Of these, some 20 per cent will train to become Air Engineer Officers in the Fleet Air Arm.

Under the new three-phased Dartmouth training scheme cadet entrants go to sea as acting sub-lieutenants on successful completion of their entry courses. Allocation to the various specialist branches (Seaman, Engineer, and Supply and Secretariat) takes place at the commencement of Phase 3.

During their initial sea commission all engineering specialists must obtain a certificate of competence in upper-deck work and, on the engineering side, qualify for their auxiliary watchkeeping, boiler-room and unit certificates and for an engine-room watchkeeping certificate for one class of ship. From sea they join the R.N. Engineering College for the two-year basic engineering course.

At Manadon they are trained up to professional standard as mechanical engineers. Subjects taught include mathematics and the sciences (including physics, chemistry and metallurgy, mechanics and thermodynamics); electronics and electrical





(Left) Instructional aircraft—including Sea Hawk, Sea Venom, Gannet, Firefly and Sea Fury—in the airframe hangar at Manadon. (Above) Wind tunnel in the aerodynamics laboratory.

engineering; and practical engineering and engineering economics, which includes training in mechanical drawing, machine design, the use of hand and machine tools and the basic methods of production engineering. The officer side includes divisional work, power-of-command training and general education. Progress examinations are held periodically, and a final examination, set and marked by examiners drawn mainly from the universities, is held at the end of the last term. Successful graduation confers exemption from Sections A, B and C of the examinations of the Institution of Mechanical Engineers and qualifies the candidate for graduate membership of this body.

On conclusion of this period of training the young engineers join their colleagues in the other branches, at the R.N. College, Greenwich, for a junior officers' war course. Afterwards they return to Manadon to undergo sub-specialist training as either marine, aeronautical or ordnance engineers.

The duration of the air-engineer course is one year (three terms of 14 weeks), undergone mainly in H.M.S. *Thunderer*, which is the ship name for the Engineering College. The training provides a thorough grounding in the theory and practice of aeronautical engineering, enabling the qualified Air Engineer both to obtain the maximum performance from the equipment he handles and, according to ability and opportunity, to contribute to the design and development of naval aircraft and equipment.

Extending and applying that given in the basic course, the instruction includes theoretical work on the principles of aero-dynamics and aerostructures, aero-engine and airframe design considerations; automatic control and electronics, and the applied academic subjects. Practical maintenance work and schedules are performed on airframes and engines, and air administration is taught both as a separate subject and, whenever possible, as part of practical aero-engineering work. Demonstration and practical laboratory work is done in wind-tunnel and test rigs in connection with aerodynamics and aerostructures. The training syllabus also includes flight deck machinery, catapults, arrester gear and ships' fuelling systems.

Training in divisional work and leadership is continued, and lectures on these subjects are given, together with talks on current affairs and the humanities. Sport and recreation are by no means neglected. Manadon boasts rugby, soccer and hockey grounds, tennis courts and a cricket pitch, squash courts and a fine gymnasium. The college has its own boathouse on the Hamoaze, and three yachts, two whalers, and ten dinghies are available for sailing.

Built on the site of a centuries-old, 100-acre estate, the new engineering college at Manadon was planned as far back as 1938, when it was evident that the expansion necessitated by the increasing scope and complexity of naval engineering, and the growth of the aeronautical and gunnery aspects, was impossible at the old Engineering College at Keyham, which had been functioning since 1880. World War II held up building work, but Manadon is expected to be complete by 1960, and the entire training of naval engineers will be concentrated there with resultant economy.

Instructional facilities for air-engineer training include an engine-repair shop, with a "museum" for design appreciation. Among the engines displayed are Nene, Ghost, Derwent, Avon, Clyde, Centaurus and Theseus. There is a Jumo from a wartime Junkers, and a V.2 rocket motor.

The engine test-house at present contains a Griffon, soon to be replaced by a Mamba turboprop. Here the students are taught engine handling; faults are simulated and rectified; and speed, boost control and fuel and h.p. are measured. A turbojet test-house is under construction, in which a Nene will be installed.

The aerodynamics and air-structure department is accommo-

The planned new accommodation block.

Practical leadership training—in the snows of Glencoe.

TRAINING THE NAVAL AIR ENGINEER . . .

dated in one of two large hangars. Obsolete aircraft act as patients for metal repair work; and there are also wind tunnels, smoke tunnel, wing stress rig, component-repair section and dope shop. Here also is what must be the world's smallest and cheapest supersonic wind-tunnel. Capable of testing up to Mach 1.4, the tunnel was made from scrap material and is claimed to have cost only 7s 6d.

The airframe hangar contains an array of makers' scale models of naval aircraft of past and present types, ranging from the Blackburn Roc to the Wyvern and Gannet, and includes a number of helicopters. Stripped completely to show the development of airframe structures is one of the only two existing Swordfish—the other is maintained in flying condition at Lee-on-Solent. A Seafire and a Wyvern are also partially stripped of skin to demonstrate structural strength. Primary structures are painted red, secondary yellow, and tertiary green. The rotor-head and main gear of a Hiller and a Whirlwind represent the helicopter side. A Gannet, Sea Hawk and Venom are maintained for servicing instruction.

Flying experience is given at Plymouth Airport, Roborough, where the R.N.E.C. maintains two hangars housing the college's two aircraft, a Balliol and an Oxford "flying classroom."

The acquisition of pilot wings by naval air engineers is encouraged, and about ten a year complete flying training. Appropriately, Manadon's senior aircraft-engineer instructor is himself a pilot.

During their sub-specialist course the students visit various other establishments. These include a week's stay at R.N.A.S. Culdrose at the outset, to gain naval air station experience and, towards the end of the course, visits to engine and airframe factories. They also visit the Royal Aircraft Establishments at Bedford and Farnborough to see the latest developments, and a naval aircraft repair yard. In addition they look in on H.M.S. *Ariel* to find out how air electrical officers and ratings are trained.

Fairly early in the course students are required to write a thesis on a personally selected subject allied to air engineering. The idea is to provide a constructive example of report writing and to familiarize students with the work of consulting references. Original suggestions covering research and application are encouraged, and marks awarded for the thesis count towards the final examination results. Successful candidates in the final examination are exempted from the Royal Aeronautical Society's examinations for associate fellowship.

Budding air engineers are also required to take part in a "design and make" project during the course. The college staff represent the Ministry of Supply and prepare an initial specification. The work is carried out by student syndicates, each of which includes a general manager, chief designer, sales manager and cost accountant. In competition with each other the teams submit their tenders; and then design, cost and manufacture all items used except proprietary articles. The teams' sales campaigns take a number of forms, from slipping a temptingly worded leaflet into staff "in" trays to advertisements on the college notice-boards.

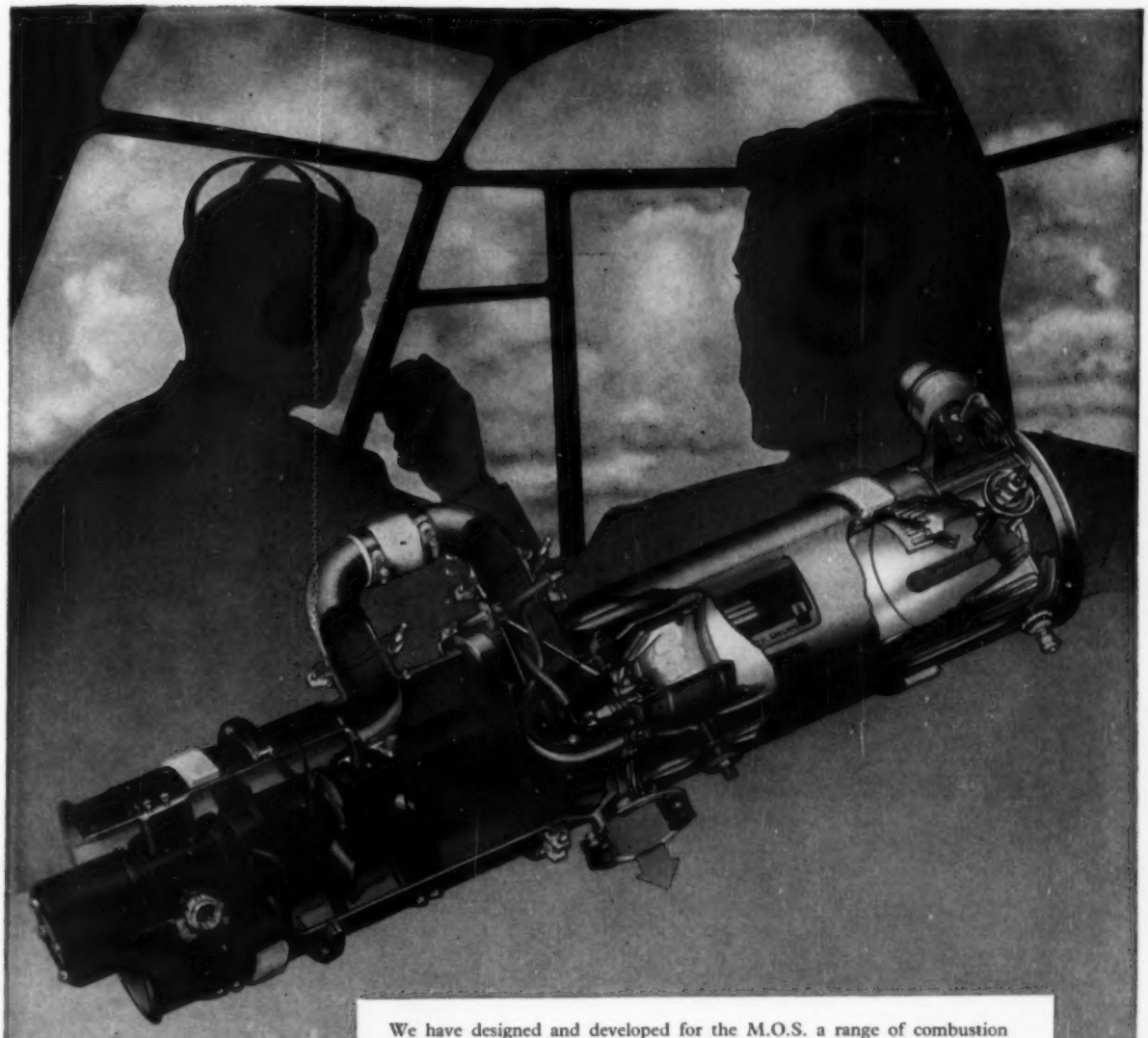
The syndicates operate under home-made names, and the designation of their devices can be novel and humorous. But all must function properly, and those which can be so adapted are fitted in an old car and are required to propel the Captain once round the college grounds. The best examples are preserved in a showcase, and include the *Willitt Brake*, the *Ph-f-f-t Phan* (appropriately manufactured by the *Ph-f-f-t Phan Phederation*), the *Suc'n Pump*, and the *Woompetah Mark I*, an ingenious device the precise purpose of which baffled the present writer. The most recent additions to the design-and-make museum were two well-made types of pulsejet, one with rotary valves and the other with reeds.

The objects of the design-and-make project, in which the marine and ordnance engineers also take part, are to teach appreciation of the relationship between design and production; to give realistic experience in the application and integration of the applied sciences, mechanical drawing and workshop practice; to develop judgment in considering manufacturing or repair methods; and to develop sound and constructive critical sense in regard to existing designs.

Other trainees who come to Manadon for specialist courses are ex-Upper Yardmen sub-lieutenants who, after promotion from artificer, undergo an eight-month general-education course at the R.N. College, Greenwich, followed by a 16-month course at Manadon where they join up with the cadet-entry officers. Thereafter their training follows the same pattern. Special-duties officers of the Air Branch undergo a six-month professional course at the R.N.E.C., and all student air engineers belonging to the Canadian, Australian, Pakistan and Indian navies also receive their professional training at Manadon.

All air-engineer graduates from the college are fully qualified for appointment to first-line Fleet Air Arm squadrons as assistant air-engineer officers. But, since the college teaches only principles, a short post-graduate course at the School of Aircraft Maintenance is necessary for specialization in the various aircraft types.

(Right) The engine shop, with a Python in the foreground; the small unit alongside is an early Walther A.T.O. rocket motor. (Below) Manadon House, at present used as the staff mess.



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(The audience agreed that the noise level had indeed dropped by well over 50% and the Managing Director was carried out, black in the face, amid loud cheers).

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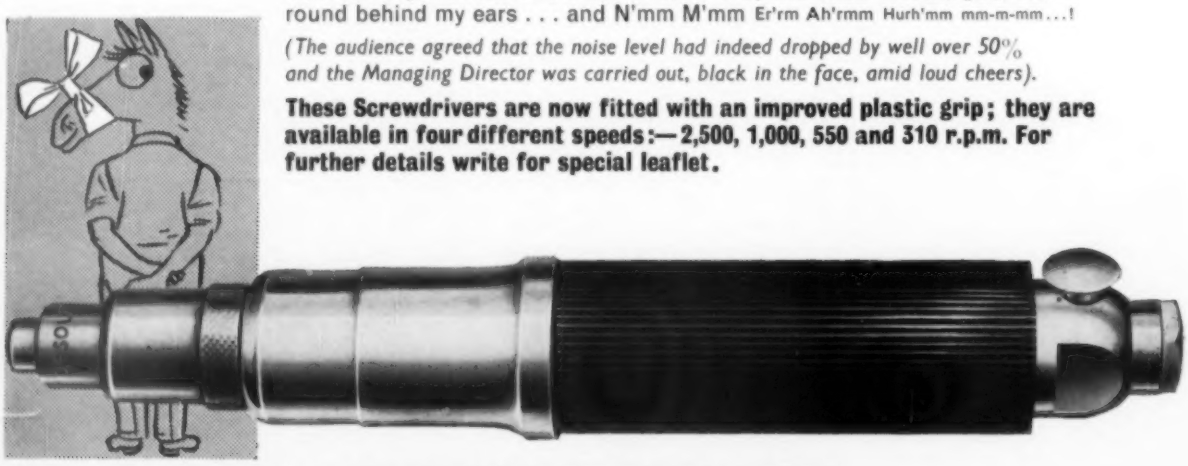

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SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

No. 202 Sqn. Standard

AT Aldergrove on September 6 a Standard is to be presented by Air Chief Marshal Sir Douglas Evill to No. 202 Squadron, which in its earliest days—at Christmas, 1914—attempted to intercept from Dover the first enemy aircraft ever to drop a bomb on British soil.

Formed in October 1914 and equipped at that time with Bristol biplanes, No. 202 was designated No. 2 Sqn., R.N.A.S., until the formation of the R.A.F. in 1918. At first it operated from Eastchurch and Westgate as well as Dover, then from 1916 to the end of the war—the period during which Air Chief Marshal Sir Douglas Evill was one of its commanders—in the Dunkirk area, mainly on reconnaissance.

No. 202 was disbanded in 1920 but re-formed nine years later at Malta, and at the outbreak of the last war was equipped with London flying-boats. Subsequently it had Sunderlands and Catalinas, in 1942 supplying the Catalina which picked up General Mark Clark after his clandestine visit to Algiers to meet French leaders; and it was credited after the war with the destruction of three enemy submarines and a share in the sinking of three others. Now, commanded by S/L. C. A. Sullings and equipped with Hastings, No. 202 Sqn. patrols five days a week over the Atlantic, passing weather information to the Meteorological Office.

Battle of Britain "At Homes"

THIRTY-SEVEN R.A.F. stations [as mentioned in a news-item earlier in this issue] will be open to the public on September 14, the Saturday in Battle of Britain week. The full list, named under counties and countries, is as follows:—

Buckinghamshire, Halton; *Cambridgeshire*, Duxford; *Cornwall*, St. Eval; *Devon*, Chivenor; *Gloucestershire*, Little Rissington; *Hampshire*, Andover; *Huntingdonshire*, Upwood; *Kent*, Biggin Hill; *Lancashire*, Weeton; *Lincolnshire*, Binbrook and Hemswell; *Middlesex*, Hendon; *Norfolk*, Horsham St. Faith; *Northumberland*, Acklington; *Nottinghamshire*, Syerston; *Oxfordshire*, Benson; *Rutland*, North Luffenham; *Shropshire*, Ternhill; *Staffordshire*, Cosford; *Suffolk*, Honington; *Sussex*, Tangmere; *Warwickshire*, Castle Bromwich and Gaydon; *Wiltshire*, Colerne; *Yorkshire*, Church Fenton, Dishforth, Leconfield, Lindholme, Norton and Thornaby; *Wales*, St. Athan and Valley; *Northern Ireland*, Aldergrove; *Isle of Man*, Jurby.

Dipping Asdic Demonstrated

DURING Navy Days at Chatham over the August Bank Holiday weekend the first public demonstration of the technique of detecting submarines by helicopter—known as "dipping asdic"—was given by a Fleet Air Arm Dragonfly in co-operation with the frigate H.M.S. *Grenville*. The method consists of lowering a listening device by wire into the sea, enabling the helicopter itself to make an attack or to home other aircraft or surface ships to the scene. [A photograph of the Dragonfly —which also gave net-rescue demonstrations—alighting on H.M.S. *Grenville* is published on p. 228.]

Weather Ships' Anniversary

RECENTLY the Air Ministry's four ocean weather ships—based at Greenock, Scotland, from where they go out to act as meteorological stations and as guard-ships on the North Atlantic air routes—reached their 10th anniversary; for it was on August 5, 1947, that the first of these ex-Naval corvettes, *Weather Observer*, began observations at Station "J", 300 miles west of Ireland, after sailing on August 1 from London dock.

During the past ten years, while on duty at their stations in rotation with French and Netherlands vessels, these ships—the other three are named *Weather Explorer*, *Weather Watcher* and *Weather Recorder*—have carried out twice-daily radiosonde observations of the upper air and six-hourly radar wind observations of upper winds, as well as maintaining a full programme of surface observations every three hours and broadcasting them by radio. They have also, in recent years, made special observations of sea-water temperatures by bathythermographs, to a depth of about 75 fathoms (450ft); and *Weather Explorer* has been making special wave observations by an electric wave-recorder.

All four ships have co-operated in search and rescue exercises with Coastal Command aircraft wherever possible. Last October, *Weather Watcher* vacated her station to search for a missing U.S. Clipper aircraft, and in December *Weather Recorder* was called away in heavy weather to stand by a damaged ship. As well as their meteorological work the weather ships' duties include navigational aid to aircraft, limited air traffic control, air-sea rescue and oceanographical and other scientific activities; while in addition ornithological observations have been undertaken.

Each of the weather ships—which are stationed variously 300 miles west of Ireland, 300 miles south of Iceland, midway between Greenland and Iceland, and 300 miles north-west of Cape Finisterre—spends up to five weeks at sea and has a crew of 53, which includes seven meteorologists, and radar and radio personnel.

R.A.F. Appointments

BELOW is continued a list of R.A.F. appointments recently announced by Air Ministry:—

G/C. G. F. Alexander to Ministry of Supply.

W/C. G. N. Blake to Air Ministry, for duty in the department of the Air Member for Supply and Organization; W/C. F. A. Buckingham to H.Q., Maintenance Command, for administration staff duties; W/C. F. G. Toone to Air Ministry, for duty in the department of the Air Member for Supply and Organization; W/C. J. H. Woffindin to R.A.F. Yatesbury, for technical duties; Acting W/C. F. D. Pryce to H.Q., F.E.A.F., for administration staff duties; Acting W/C. H. G. A. Scilley to R.A.F. Coningsby, for technical duties.

S/L. F. Murray to the School of Administration, to instruct (with the acting rank of wing commander); S/L. R. Los to R.A.F. Wittering, for technical duties (with the acting rank of wing commander); S/L. H. Woolstencroft to Air Ministry, for duty in the department of the Air Member for Supply and Organization (with the acting rank of wing

With M.E.A.F. aircraft much in the news now, this "family album" group shows (to the right) a Pioneer of No. 78 Sqn. and a Venom of No. 8 Sqn.—complete with sun-hat—at Khormaksar; and below, their fuselage tops painted white, Beverleys of No. 47 Sqn. at Khormaksar and a Shackleton of No. 42 Sqn. of Sharja. Both Venoms and Shackletons have been actively employed in Oman operations, the former attacking rebel positions with rockets and cannon fire, the latter dropping leaflets and (at the end of last week) 20 lb fragmentation bombs.

SERVICE AVIATION . . .

commander); S/L. T. M. G. Bury to H.Q., Transport Command, for technical staff duties (with the acting rank of wing commander); S/L. C. S. Hunton to R.A.F. Khormaksar, for flying duties (with the acting rank of wing commander).

M.O. Postings

THE following medical officer appointments have also been announced recently by the Air Ministry:—

G/C. R. H. Pratt to A.H.Q., Levant; G/C. J. C. Taylor to H.Q., British Forces, Arabian Peninsula; G/C. E. B. Harvey to H.Q., Fighter Command; G/C. L. S. Everett to H.Q., No. 64 Group; G/C. C. E. G. Wickham to H.Q., Flying Training Command.

W/C. S. M. Bieber to H.Q., British Forces, Arabian Peninsula; W/C. R. D. Bruce to Air Ministry Unit; W/C. H. W. Whittingham to R.A.F. Henlow.

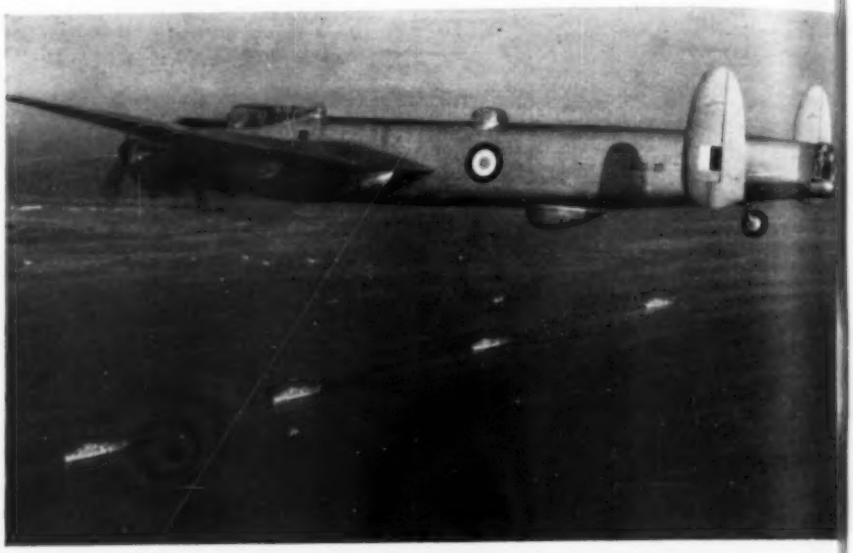
C-130s for R.A.A.F.

TWELVE Lockheed C-130s—sufficient to re-equip a squadron of No. 86 Transport Wing of the R.A.A.F.—are to be purchased by the Australian Government. The first two are scheduled to be taken over by R.A.A.F. crews at the Lockheed factory at Marietta, Georgia, in October 1958; and the remaining aircraft are expected to be delivered before the end of that year.

An official announcement by R.A.A.F. Headquarters of this decision to purchase C-130s says that their acquisition will mean that "the R.A.A.F. can now fly personnel and equipment of all kinds non-stop over long distances, such as Melbourne-Darwin, Sydney-Manus, or Darwin-Singapore. The C-130s will make it possible for the R.A.A.F. to give adequate logistic support to the jet fighter and jet bomber squadrons which will join the Commonwealth strategic reserve in Malaya next year. The C-130 transport unit could fly a complete operational squadron of men and equipment from any point in Australia to any point in South-East Asia within 24 hours."

No. 26 Sqn. Dinner

A DISBANDMENT dinner is being held by No. 26 Sqn. in Amsterdam on October 12, and present members are anxious to see as many ex-members there as possible. To facilitate this, very reasonably priced tickets for a return air journey from the London area will be available. Inquiries should be made to F/O. E. E. Jones, No. 26 Sqn. Reunion Secretary, at R.A.F. Oldenburg, B.A.O.R. 25.



An Australian-built Avro Lincoln of No. 1 (R.A.A.F.) Sqn., based at Tengah on Singapore Island, flies over warships off the coast of Malaya during a recent SEATO exercise.

IN BRIEF

The Queen received Air Marshal Sir Francis Fressanges, who recently relinquished command of F.E.A.F., at Buckingham Palace on August 6 and conferred the accolade of knighthood in respect of the K.B.E. awarded him in June 1955.

* * * * *

Air Chief Marshal Sir Hugh Saunders has been appointed chairman of the Alexander Duckham Memorial Schools Committee of the R.A.F. Benevolent Fund in succession to A.V-M. Sir Douglas Harries, who has resigned after 11 years' service.

* * * * *

Two R.C.A.F. Lancasters of No. 407 (Maritime) Sqn. are carrying out ice reconnaissance duties from Cambridge Bay, on the south of Victoria Island, for the U.S. Navy marine task force taking Distant Early Warning line supplies into the Arctic.

* * * * *

The R.A.F. Modern Pentathlon Championships—comprising fencing, shooting, swimming, cross-country running and riding—are being held at Cranwell from August 30 to September 3. Individual competitors and teams of three from R.A.F. stations are taking part and from them the R.A.F. team for the Inter-Service Championships—also to be held at Cranwell, from September 18 to 21—will be selected.

* * * * *

The Gliding Section of the R.A.F. College, Cranwell, organized a gliding camp at the Derby and Lancs Gliding Club site at Camphill from July 31 to August 14. Four officers and ten cadets participated, headed by F/L. R. A. E. Dunn.

* * * * *

The W.R.A.F. Central Band is to make a recruiting tour of West Country areas—including Exeter, Torquay, Plymouth and Penzance—from August 26 to September 1.

* * * * *

Eighteen Cranwell cadets who have been visiting the Mediterranean Fleet will fly from Catania to Malta tomorrow (August 17) to spend four days with the Fleet Air Arm at R.N.A.S. Hal Far before returning home.

This group photograph of No. 234 (Madras Presidency) Sqn.—commanded by S/L. E. A. Risley—was taken shortly after the squadron's Hunter 4s had flown their last sortie in 2nd T.A.F. before disbandment.

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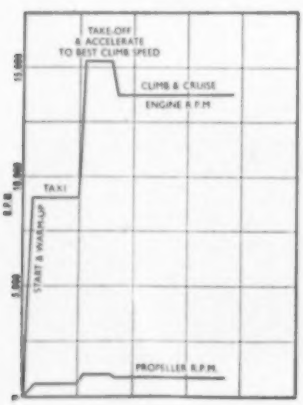

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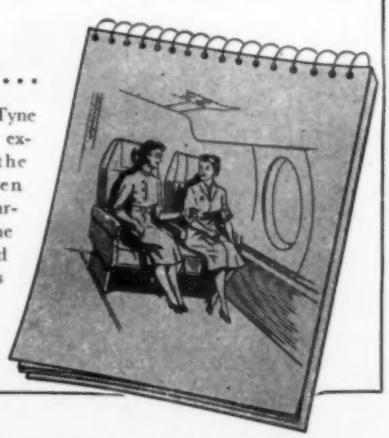

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CIVIL AVIATION

COMMENTS ON THE MILLBOURN REPORT

By J. M. RAMSDEN

TWO weeks have passed since the publication of the Millbourn Committee's recommendations on the future of London Airport. These were summarized in *Flight* last week. Public reaction to the suggestion that a further £17 million of their money should be spent on an airport which will already have cost nigh on £30 million has on the whole been mild, even though this spending is proposed at a time when the nation is more concerned than ever about its economy.

The only real protest came from Lord Selborne. In a letter to *The Daily Telegraph* on August 5 he referred to "squandermania"; and his criticisms were aimed at the planners who designed the original L.A.P. Central. They were not new criticisms, but they were worth repeating. We recall pertinent questions being asked about the wisdom of "upstairs-and-downstairs" passenger handling when the original design was announced, and we asked—and later expressed our doubts in print—about the lack of consideration given to the American finger-and-gate system. (B.E.A. felt strongly about that one too—and said so at the time.)

It can be argued that the public must accept continued expenditure on its airports and ground aids just as it approves expenditure on our antique road-system. It is of course the motorist who pays for new roads—and for much else besides—whereas the airlines pay only a fraction of the cost of the airports and facilities they use. But air transport, which has been big business for only a dozen years, cannot yet afford to pay for the consequences of its coil-spring expansion, and comparisons between the air and the old-established forms of transport such as shipping are false. The U.S.A., which possesses the world's most adult air transport industry, has paid up $325 million of taxpayers' money for the improvement of its airports and airways over the past ten years.

Certainly we must have the best possible facilities upon which to build our air commerce, but might we not do well to plan expensive expansions so that the nation does not find itself paying up—and being expected by the airlines to pay up—for ever? Sir William Hildred, director-general of the International Air Transport Association, prompted this question in his recent criticism of the Minister of Civil Aviation's decision to increase landing charges. At a luncheon in Washington in May he said:—

"About three weeks ago there was sitting on my right at a luncheon the Minister of Transport and Civil Aviation in the United Kingdom. I mentioned, more in sorrow than in anger, what the British Government had just done with landing charges. They had shoved them up by a cruel percentage and he hadn't the grace even to apologize. In fact, when I said he had put them up thirty per cent, he interjected, 'in some cases fifty,' and was absolutely shameless about this. That is another thing we have to deal with."

Sir William spares not even himself in his tireless and enlightened championship of his airlines, and the Minister probably took his criticism in good part; but this is not—and even Sir William would agree—an outlook which the airlines can expect to maintain for ever.

The Proposals

With such thoughts in our minds we might take a closer look at the Millbourn proposals and see whether the Minister's acceptance of them as they stand is likely to embarrass his Ministry and the Treasury fifteen years hence. The proposals are the outcome of 18 months' hard work by a committee composed of eight Ministry experts and a representative from each Corporation. Their report presents in broad-brushwork form a comprehensive plan for the London Airport of 1970. It does not confuse the issue with detailed design-proposals, and its 16 pages are notable for their lucid and reasoned appraisal of a big and complex problem. It is in fact a model of what all government planners' reports should be. It is not a cockshy; but neither is it final and conclusive, and therefore we might express a doubt or two about some of its proposals.

We remarked in a leading article last week that, in principle, an airport like London with a central island terminal is basically inflexible. It cannot be expanded without eliminating valuable runways, which after all (and assuming continued technical improvements in A.T.C.) should be the final limitation of an airport's capacity; and road and rail access requires very expensive tunnelling. There are other objections, such as awkward liaison with the engineering bases, but these are trivial compared with the basic problems of limited expansion-room (particularly for aircraft stands and car parks) and expensive access for the airport's customers.

Our point was that no convincing case had been put for the rejection of L.A.P. North as the long-haul terminal, and that transplanting it to the central island according to the original plan might be bitterly rued in the future. Although London's long-haul traffic is in the minority (15 per cent) compared with short-haul, there can be no certain prediction that the proportion will remain thus small. Long-haul business is about to be revolutionized by the DC-8 and 707 and by thrift-class fares; and, furthermore, the full impact of the big jets on terminal facilities—as the Millbourn report itself points out—cannot be exactly foreseen. Refuelling, the loading and unloading of 150 passengers at a time, jet blast and noise, taxying and so on, are all problems which we may be underestimating.

But even if the big jets were to present no operational difficulties the wisdom of putting long-haul traffic in the centre might still be questionable. The main argument against keeping the long-haulers out of the centre is to make the most economical use of a central area the boundaries of which are fixed, and which in future years may need every bit of space for short-haul traffic. The fact that the big jets will require special terminal treatment lends added weight to this argument.

Bold Reconstruction

The report says of London Airport North that "there is no room for expansion." Everyone agrees that L.A.P. North is hopelessly inadequate and congested as it is, and that new permanent buildings are urgently needed. But could not second thoughts be given to the possibility of its reconstruction, and its outward and inward expansion between No. 1 runway and the Bath Road? The present L.A.P. North area is a wastefully under-utilized shantytown of temporary huts: bold reconstruction and imaginatively economical use of space, and, at worst, diversion of the Bath Road (a scheme envisaged by L.A.P.'s previous planners), might achieve a terminal facility and aircraft parking space at least as spacious as is proposed for the long-haulers in the centre.

It could be argued that in any case London Airport will run out of runway capacity before it runs out of terminal capacity, and that the central area is, in fact, large enough to handle all the traffic that the runways can take with the advances in A.T.C. capacity foreseen by the report. What point, therefore, in suggesting that the central area's limited space be kept in hand by excluding the long-haulers?

The answer is that we may be able to find ways of making use of L.A.P.'s runway capacity—i.e., A.T.C. capacity—more fully than we do at present. The Millbourn report bases its estimates for the future on the number of aircraft movements in *peak* periods: yet it is questionable whether we should plan expansions based on peak demands in only a few hours of the year. Are there not opportunities for economic incentives—such as differential airport charges—designed to spread peak movements more evenly throughout the day or the week? Such charges would not be easy to implement, nor would they be popular: but would they not be in accord with peak-demand practice in other forms of business? Acceptance by the airlines of differential charges (which, after all, they themselves apply to their own customers), or of other means of spreading the load, would be in accord with the need suggested earlier for a change of outlook by the industry towards the facilities provided for it.

Writing in the May 1957 issue of *Shell Aviation News*, Mr. S. F. Wheatcroft, economic adviser to B.E.A., gave his personal views about the utilization of London Airport's facilities:—

"It is worth noting that if the capacity of London Airport in 1955 was reckoned at 35 movements an hour—not an unreasonable figure for a parallel-runway airport—the capacity utilization figure was only 34 per cent. I am well aware that this figure may be regarded as dangerously misleading, but it does seem to me to be salutary, when considering the duplication of a £30 million asset, to start off with the thought that the existing one is at present used at only one-third of its theoretical capacity. . . . It can be said, however, that the airlines are becoming increasingly conscious of the fact that, sooner or later, they will have to pay the full cost of the airports they use and are, therefore, seriously concerned about their efficiency and high utilization."

His point was that a situation could arise in which demand for additional capacity in the peak period might lead to the building of a new airport at a cost out of proportion to its value—an airport which would never have been built if the peak traffic had been required to pay the full cost of the additional facilities needed.

The Millbourn report justifies its proposal to eliminate No. 4 runway and to extend ominously close to the No. 6 parallel by pointing out that meteorological data show that the airport would be 99.86 per cent usable without these N.W./S.E. runways, assuming that steady cross-wind components of up to 18 kt are acceptable. It may be true that these runways only *have* to

(*Continued at the foot of page 236*)

Between its first flight and the resumption of the flight test programme this week, the Accountant has undergone ground resonance testing. Considerable overseas interest in the aircraft has been reported by Aviation Traders.

CIVIL AVIATION . . .

BREAK-THROUGH FOR THE ELAND

THE first airline order for Napier Eland turboprop engines has been officially confirmed by the manufacturers. As already foreshadowed, R.E.A.L. of Sao Paulo, Brazil, have signed a contract for the conversion of three of their Convair 340s to take Eland NEl.6s in place of the existing Pratt and Whitney R.2800 piston engines.

This order is the first fruit of Napier's determined efforts to procure Convair re-engining business, and it may well be a foretaste of considerable further business between Napier and Convair operators who are seeking to extend the lives of their Convair 340 and 440 fleets. R.E.A.L. say that, depending on the outcome of initial operating experience, they intend to convert the remainder of their Convair 340/440 fleet of some 20 aircraft. The conversion work will be undertaken by the PacAero Engineering Corp. of Los Angeles, California; complete power units will be delivered by Napier from England to PacAero, who will be responsible for their installation and associated airframe modifications (see *Flight*, February 3, 1956). PacAero are acting as Napier's agents, and, as already reported, are at present converting for Napier a Convair 440 to accelerate the certification programme. This aircraft should be flying with Elands early next year; in the meantime, Napier's existing Eland-Convair 340 is due to be despatched to California (it should leave in a few weeks' time) to begin its C.A.A. airworthiness certification programme. Overhaul and spares facilities for converted Convairs will be handled by the newly-formed U.S. company Napier Engines Inc.

Napiers say that they will be able in due course to make available to operators the two prototype Eland Convairs to help them through their conversion programmes. It has already been agreed that one aircraft shall be put at R.E.A.L.'s disposal for this purpose.

The Lockheed Electra's undercarriage is seen here "landing" at 170 m.p.h. while loaded to an aircraft equivalent landing weight of 125,000 lb (40,000 lb above normal). In this particular test, the simulated rate of descent was 12ft/sec.

ALITALIA AND L.A.I. MERGE

THE long-drawn-out negotiations about a possible merger between Italy's two leading airlines, Alitalia and Linee Aeree Italiane, have at last been concluded. Henceforth there will be a single airline known as Alitalia-Linee Aeree Italiane. Hitherto Alitalia, in which B.E.A. and B.O.A.C. have a large shareholding, have operated domestic and foreign services (some of the latter in pool with B.E.A.). L.A.I., in which T.W.A. hold a 40 per cent share, have also operated domestic and foreign (including transatlantic) services.

No details of the financial structure of the new company have been made public, but it is likely that T.W.A.'s share in L.A.I. will be taken over by the Italian Government. The British Corporations' share in Alitalia will apparently continue in the new company.

It seems that the majority of shares in the new A.L.A.I. will be held by the Italian Government through its Institute of Reconstruction. This Institute, which has been described as "vastly wealthy," is expected to put nearly £29 million into A.L.A.I. over the next four years to increase the total fleet to 50 aircraft. The new airline's most modern aircraft are L.A.I.'s ten Viscounts and four L.1649As, and Alitalia's four DC-7Cs. Sizeable orders for new long-range and medium-range turbine aircraft may be expected from the new Italian airline.

COMBINED PURCHASE OF A.N.A.?

FOLLOWING separate proposals by Ansett Airways and Holyman to buy Australian National Airlines (the Australian Government is no longer a prospective purchaser of the private airline), a joint purchase proposal is now expected. If a decision is reached, the protracted negotiations about the future of A.N.A. may soon be at an end.

MALAYAN AIRWAYS' FUTURE

PROPOSED changes to the structure of Malayan Airways were announced in Singapore on August 11. The company's main shareholders are Blue Funnel Line, Straits Steamship Co., and B.O.A.C. (with a minority interest). Under the new proposals the B.O.A.C. shareholding becomes "substantial," as does that of Qantas. In addition, five governments will hold shares in the future Malayan Airways: Singapore, Malaya, Sarawak, Brunei, and British North Borneo.

MILLBOURN REPORT (*continued from p. 235*).

be used on 0.14 per cent of occasions; but the point is surely that they *could* be used by modern aeroplanes—which are quite happy in crosswinds of up to 18 kt—on a very high percentage of occasions. It is in fact being proposed that perfectly usable runway capacity (given the A.T.C. capacity) is not needed at all.

A final point concerns the estimate of £17 million—which is additional to the estimated £16 millions needed for what must be considered as the vital rail link to and from the centre of London to L.A.P. The sum of £17 million is much more than half the total cost of the complete airport to date, and it would have been illuminating to have seen in the report a rough estimate of how the sum is broken down.

Summing up, then, we must make sure that London Airport is developed so as to utilize fully (1) its runway or A.T.C. capacity and (2) its terminal capacity. The Millbourn proposal to put all the terminal eggs in the central basket may be setting a limit on further expansion there; and though this might not be serious if we could be sure that L.A.P. will run out of runway capacity first anyway, it can be argued that the wisdom of planning for peak-period movements is questionable, and that the airlines must eventually be required to accept either economic differentials or delays during peak periods. Certainly any proposal to eliminate existing runway capacity should not be lightly accepted. Thus the possibility of redeveloping L.A.P. North for the long-haulers could be given further examination.

"Flight" photograph

A view of the Fokker Friendship which emphasizes the surprisingly high aspect ratio and big-capacity fuselage of this Dutch best-seller. Orders for Fokker and Fairchild built machines now amount to 108.

REPRESENTATIVE VISCOUNT 810 FLIES

THE first of B.E.A.'s order for 14 Viscount 806s, G-AOYF, made its first flight last Friday at the Vickers-Armstrongs airfield at Weybridge. The aircraft has been fitted with Dart 525s instead of this model's 520s, increasing shaft horsepower from 1,700 to 1,800 to bring performance (365 m.p.h. cruise) up to Viscount 810 standard. Painted in Vickers' blue and white house colours, and with "Viscount 806-810" displayed on it, the aircraft will be used to initiate the Viscount 810 programme of performance tests. Tropical trials will begin next month at Salisbury, Johannesburg, and Kano.

The first true Viscount 810, structurally modified for the increased power of the 2,100 s.h.p. Dart 541 (when it becomes the 400 m.p.h. Viscount 840) is due to fly this autumn. First deliveries of these aircraft to Continental Air Lines of Denver are due to start at the beginning of 1958.

The last of B.E.A.'s fleet of Viscount 802s has now been completed; unlike those of its predecessors, the polished aluminium surfaces have been painted grey-green—the colour-scheme intended for B.E.A.'s Vanguard fleet, whose milled wing-skins are to be thus painted for anti-corrosion reasons.

B.K.S. INTRODUCES THE AMBASSADOR

READERS of *Flight's* Public Announcements column on July 12 may have noted that the British private airline B.K.S. Air Transport, Ltd., applied to the Air Transport Advisory Council for permission to operate Ambassador (B.E.A. Elizabethan) aircraft on a number of the company's already approved domestic and international routes.

B.K.S. now announce the introduction of Ambassador G-AMAD on the company's regular scheduled service between Newcastle and Dublin. The aircraft, the first of "several" bought by B.K.S., took over from the usual DC-3 on August 9, cutting flight time by a quarter.

B.K.S. are the second airline to purchase Ambassadors from B.E.A.; the first was Butler Air Transport of Australia, who have three in service. Purchase price has unofficially been quoted at £150,000 per aircraft.

ONE-WHEEL LANDING

LAST Sunday evening, August 11, B.O.A.C.'s Constellation 749A G-ANNT *Buckingham* made an emergency landing at London Airport with the port-side main wheel retracted. The aircraft, with 17 passengers aboard, was on service from Singapore, and had suffered a hydraulic failure soon after leaving Frankfurt. The passengers were told that flaps and undercarriage would have to be operated manually, and Capt. F. K. Bainbridge and his crew attempted to lower the gear with the emergency hand-pump. Unfortunately, the port gear would not extend, and after circling L.A.P. at a low altitude for nearly two hours Capt. Bainbridge decided to attempt a one-wheel-down landing while daylight remained. The operation was completely successful, with the minimum of damage to the port wing and engines.

CARAVELLES FOR T.A.A.?

WEIGHT has been added to previous reports (see *Flight*, March 29, 1957) that Trans-Australia Airlines may order Caravelles by an announcement in Melbourne by Mr. W. McDonald, chairman of the Australian National Airlines Commission. Speaking at a press conference after an eight-week visit to the U.S.A., Canada, Europe, and Britain, he said that T.A.A. is likely to buy Caravelles if "certain difficulties" can be overcome. The aircraft would be available in February 1959, at a cost of £720,000 each (U.K. sterling equivalent), but would have to be modified for use in Australia, where they would be required to carry full payload on the 1,400 mile stage between Adelaide and Perth. A definite decision one way or the other would, Mr. McDonald said, be made by the end of this year.

CANADIAN CHARTER TRAGEDY

A DC-4 of Maritime Central Airways, chartered to the Imperial Veterans of Toronto—a group of Canadian ex-servicemen—crashed and caught fire 18 miles south-west of Quebec last Sunday night. At the time of writing it is feared that none of the 73 passengers and six crew survived.

The aircraft was on the last leg of a flight from London to Toronto and had made stops at Prestwick and Keflavik. No distress call was made after the aircraft had established routine contact with Quebec, and the weather was reported to be generally clear, although there were scattered thunderstorms.

Reported on this page is the introduction of Ambassador services by B.K.S., the private British airline. Here is their first machine, G-AMAD, looking just as graceful in its new colours as in the more familiar B.E.A. scheme. It will operate its new owners' international services based on Newcastle.

CIVIL AVIATION . . .

A Policy for British Air Transport

LAST April the Air League of the British Empire formed a special committee under the chairmanship of Sir Miles Thomas to formulate a comprehensive air transport policy. Here, received as this issue goes to press, is a preliminary summary of the committee's conclusions, upon which we hope to comment next week. The composition of the committee was originally as follows: Sir Wilfrid Eady, director of Richard Thomas and Baldwins, the steel manufacturers; Air Chief Marshal Sir George Pirie, chairman of the Council of the Air League; Mr. Robert Perfect, Air League Council deputy chairman and a director of Saunders-Roe; Mr. Ivor Bowen, Council member and in 1947-1950 chief superintendent of the A. and A.E.E. at Boscombe Down; and Mr. Kenneth Handover, formerly chairman of S.A.S. The secretary was Mr. Frank Hillier. Mr. Robert Perfect, as reported with great regret last week, died on August 4.

LOOKING into the future of British aviation as a whole (says the Air League report), a dominating factor is that world air traffic, as predicted by expert opinion, is almost certain to quadruple during the next ten years; and this near-certainty must be borne continuously in mind.

The Civil Aviation Act of 1946 provided that all Britain's scheduled air services should be operated by two national Corporations, British Overseas Airways and British European Airways. These two Corporations have, since their inauguration, served the country well and with great efficiency during a difficult period and in the face of many adverse circumstances, and their statutory rôle should not in any way be modified.

The committee consider that if the two Corporations were to be saddled with entire responsibility for the tremendous increase in traffic expected over the next ten years, they might become so large as to lose their efficiency. For this and other reasons advanced in our report [continues the Air League], we recommend that a proportion of the expected increase of traffic should be allocated to selected independent air transport companies. And we consider it would be wise to make use of the world-wide organization, the unrivalled experience and the traditions of some of the big shipping companies by associating them with such a project. Legislation might be required to implement this recommendation fully, but, until this can be done, we recommend that any scheduled services operated by independent companies should be on an associate basis within the Civil Aviation Act of 1946 as amended in 1952.

Some amendment is desirable in the powers and terms of reference of the Air Traffic Advisory Council so as to give it greater authority, somewhat on the lines of the Civil Aeronautics Board in the United States, but without the legal procedures of that body.

We should contemplate a closer Commonwealth organization for the development of the air transport and aircraft manufacturing industries.

Some improvement in co-ordination between the services provided by B.O.A.C. and B.E.A. should be effected; and the Committee feel strongly that these Corporations and any independent operators which may be authorized to operate scheduled services, should, while retaining their identities and operational autonomy, be integrated in so far as schedules, traffic and booking facilities and services for the convenience of the travelling public are concerned so as to present a united British front against international competition.

Nearly the largest earner of export currency of any industry in this country today is the aircraft industry, and [continues the Air League's summary] we are concerned to think that our present policy appears limited to the development of airliners only a little better than the coming generation of American airliners. We feel most strongly that this country must be imaginative and reach out into the future by proceeding to develop a supersonic airliner capable of vertical take-off and landing and of crossing the Atlantic in between two and three hours. We are satisfied from expert evidence given to us that this is a practical proposition within the next ten years; and it is for us an economic necessity as well as a matter of prestige. With such an aircraft, we should regain the blue riband of the Atlantic, increase enormously our aircraft export market and under the new Defence Policy be in a position to marshal our military forces anywhere. Such a project would, in our view, be beyond the technical and financial resources of any one firm, but we believe that if the leading firms combined in, say, syndicate form, under inspired leadership, specifically to undertake the task, the City might come to their aid financially in the manufacture of the aircraft.

A large cargo aircraft with operating characteristics which would enable cargo to be carried at about 50 per cent of current rates should be developed as a matter of urgency, and the resources of the aircraft industry should also be co-ordinated and to some extent concentrated to this end.

During the last decade, British aviation has suffered from lack of co-ordination at high level—one serious effect of which has been that the acknowledged genius of our designers, engineers and research workers has been to some extent frustrated and great opportunities lost. We feel that if Britain is to regain her proper position in world aviation in the years ahead, the whole field of aviation policy (military and civil) must be properly co-ordinated at a high level.

The committee are of the opinion that a grave error—which will have most serious repercussions on our aviation position in the world and on our export trade—is being made by the Government, in cutting down expenditure on research and development of aircraft and engines, at a time when the pace of technical progress is so fast and so world-wide. This false economy should be arrested and reversed without delay.

A proving unit, somewhat on the lines of the U.S.A.F. Proving Command [Air Proving Ground Command.—Ed.], should be established for the testing and proving of new transport aircraft.

Financial assistance should be given from Government funds to assist the training of suitably qualified young men who wish to embark on a civil aviation career, since it will no longer be possible for them to serve first in the R.A.F. or R.N.

An independent enquiry should be made by the Minister of Defence into the traditional policy of the fighting Services as regards the establishment of stores depots overseas with complete ranges of stores, with a view to discovering whether it would not be more economical to retain most of the less bulky stores in central depots and to make the fullest use of air transport for distributing replacement and "short life" items as required, as is the practice in most commercial organizations today.

BREVITIES

THE U.S. Civil Aeronautics Board finally decided on August 7 to deny the controversial application by eight domestic airlines for a six per cent fare-increase.

* * *

Two U.S.A.F. B-57s, painted in civil colours, are being used by the C.A.A. to check U.S. airways and facilities.

* * *

Capt. H. W. C. Alger of B.O.A.C. has been appointed general manager of the Corporation's associate company Aden Airways.

* * *

Mr. S. N. Baker, Pakistan's Director-General of Civil Aviation, visited Fokker recently to inspect the Friendship. He said that P.I.A. might place an order.

* * *

Mr. Airey Neave, Parliamentary Secretary to the M.T.C.A., confirmed in the Commons on July 31 that Croydon would be closed as soon as Gatwick Airport was open to traffic next spring. The Government was, he said, still consulting about an alternative base for the light aircraft now based at Croydon.

Canadian Airline Pilots Association has changed its address to Canadian Aviation Building, Montreal Airport, Canada.

* * *

Mr. P. Holroyd Smith, C.B.E., has been appointed general manager of Cyprus Airways. He succeeds Mr. J. R. Vick.

* * *

B.O.A.C., in association with the American Express Company, are offering a new and inexpensive seven-day tour of Bermuda. Flights from New York will be in B.W.I.A. Viscounts.

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Fourteen of K.L.M.'s Convair 340s are to be returned to Europe from the Dutch West Indies and will be replaced by four DC-6s. Some of the 340s will be rebuilt as freighters.

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The Board of Compagnie Cherifienne de Transports Aeriens—now comprised of a majority of Moroccan shareholders—has changed the name of the airline to Compagnie Nationale (Royal Air Maroc). It has decided to buy a Constellation from Air France and to order a Caravelle, with an option on a second.

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

Too Many Aircraft for B.O.A.C.?

YOUR correspondent "Draughtsman" (July 5) expresses concern that B.O.A.C. has ordered too many Vickers-Armstrongs VC-10 turbojet transports, and that these aircraft may mean the premature disposal of the Corporation's Comets, Britannias and Seven Seas. And on page 784 of the June 7 issue are the words "The conclusion seems clear: B.O.A.C. must be planning on an all-jet fleet of 707s and VC-10s. And they appear to be counting on big increases in traffic to fill them."

But in reaching this conclusion, one very important fact seems to have been overlooked, namely, that the VC-10 is being financed privately by Vickers. The Viscount has proved that, given the orders, Vickers can produce the goods; the size of B.O.A.C.'s VC-10 order was probably determined less by future traffic requirements than by the necessity of placing a sufficiently large order to enable Vickers to offer really competitive prices and delivery dates for the VC-10 to foreign customers as well as to B.O.A.C., and a chance of selling sufficient VC-10s to break even.

Assuming this conjecture to be correct, what will the Corporation do with the surplus VC-10s on order? My guess is that they will be released for delivery to foreign carriers in the same way as Britannias have been released for sale to Northeast Airlines and Aeronaves de Mexico.

Rustington, Sussex. M. J. HARDY.

Airline Operating Margins

YOUR note on "World Air Transport in 1956" in *Flight* for July 12 draws attention to the fact that I.C.A.O. has reported an operating ratio for the world's airlines during 1955 of 102.6, as against "the figure of 101.1 so often quoted by members of I.A.T.A."

It should be pointed out that the 101.1 ratio, which I.A.T.A. and its members have quoted, was I.C.A.O.'s own provisional figure for 1955, which has only just been corrected in the Report which you comment on now.

In any event, the operating margin of even 2.6 per cent is hardly enough to assure an economically healthy industry—which has been the main point which I.A.T.A. and its members have striven to make.

S. RALPH COHEN,
Montreal. Public Relations Officer,
International Air Transport Association.

The Bristol Orpheus

IN a very interesting article on the Orpheus jet engine in your issue of July 5, you state: ". . . the Orpheus is in a sense a replacement for these centrifugal engines (i.e., the Derwent and Nene), being in the same thrust class, though of much lighter weight."

It may seem too obvious to be worth repeating that weight is the most important parameter of any aircraft component. But in this connection it may be noted that an aircraft is designed around a certain engine *weight*, and its performance depends much more strongly on that weight than on the thrust obtained. Therefore, if you look back on the developments of almost every aircraft, you will see that replacement engines have about the same weight as the original, but more power. Not nearly so much is gained by just putting in a lighter engine. Similarly, development of any engine almost always implies getting more power from a given size and weight.

The really interesting point about the Orpheus is that on a weight basis *it is not a replacement for any other engine*, but an entirely new class.

Like most other companies, Bristol studied a large number of expendable, semi-expendable, super-lightweight, and suchlike paper engines in 1950-52, all in the 400 lb region. Finally, discarding this concept altogether, an engine project was formed in January 1952 for the B.E.22 Saturn, to weigh 800 lb. This engine was especially sized for the Folland Gnat. At the end of 1952, when the Minister of Supply made it clear they would not sponsor the Gnat, Bristol stopped work on the engine. Twelve whole months went by before the project was warmed up again under a new name, for the NATO ground support competition. During this time, as you may remember, the first Gnat had to become the Midge, and struggle along with a Viper (500 lb weight).

All successful aircraft are designed around an engine which is known to be available—if not actually off the shelf, at least well on its way there. It follows that development moves fastest if the engine builders lead the way in new concepts. This did not happen with the Orpheus: its size and specifications were really set by Mr. W. E. W. Petter of Folland Aircraft. Now that the Orpheus is a success, it is ironical that not much credit for it is given to Mr. Petter; and the chief beneficiary of the new engine is not Folland but a long list of airframe manufacturers in France, Italy, Germany and Japan.

Cincinnati, Ohio. J. M. STEPHENSON.

The Stratocruisers

I CERTAINLY did enjoy reading Mr. Dennis M. Powell's article, "The Stratocruisers Carry On" (*Flight*, June 14). These venerable aircraft have undoubtedly set a high standard of comfort, particularly on the North Atlantic routes.

I would like to add some information of my own concerning them. First of all, I believe that 56, and not 55, commercial versions of the Stratocruiser were constructed. Pan American took delivery of 21 B-377 aircraft (N1022V to N1042V). Perhaps the discrepancy is due to the fact that the Stratocruiser prototype (formerly NX 90700, now P.A.A.'s N1022V) is not regarded as a production aircraft. However, it eventually wound up as a regular commercial aircraft.

Fifty B-377s are still flying, but six have met with various accidents. The first, I believe, was the loss of P.A.A.'s N1039V over the Brazilian jungle near Carolina on April 29, 1952. The accident investigation proved to be a difficult undertaking, due to the nature of the terrain, and I cannot remember what was determined to be the cause. (Unfortunately, I am away from home at present and do not have all my notes at hand.) P.A.A.'s N1032V was lost after ditching in the Pacific off the coast of Oregon in 1954 or 1955. The ditching of P.A.A.'s N90943 was mentioned in Mr. Powell's article. United Air Lines lost N31230 around 1952 as a result of a crash during a training flight in the vicinity of San Francisco. B.O.A.C. lost G-ALSA in a crash during landing at Prestwick Airport on Christmas Day, 1954. Northwest Airlines lost N74608 as a result of an emergency ditching in Puget Sound shortly after taking off from Seattle on April 2, 1956.

Boeing report that 888 aircraft of the basic type were constructed. The majority, of course, were C-97 Stratofreighters and KC-97 Stratotankers for the U.S.A.F.

As an amateur aircraft historian, I would appreciate receiving correspondence from anyone wishing to exchange information of this nature. [S/Sgt. Robert L. Armstrong, 1933rd AACS SQ, Box 27, Harmon Field, Stevenville, Newfoundland, Canada.]

Newfoundland. ROBERT L. ARMSTRONG.

Another Avia

ON reading your excellent "Aero Engines 1957" survey, I noticed on page 127 a reference made to early activities of Polish designer W. Narkiewicz. This states that he was a senior engineer at Czech Avia works. In fact, he was supervising construction of several engines at the *Polish* Avia, which had no connection whatsoever with the Czech firm of similar name.

Avia—Fabryka Maszyn Precyzyjnych i Silnikow (Precision Machinery and Engine Factory) was established in Warsaw in 1924, and was initially engaged on production of special machinery for various industries. In 1926 "it entered aero engine business with repair and overhaul of engines of several types, and was soon entrusted with the construction and development of prototypes. These included Zalewski's WZ-7 80 h.p. seven-cylinder radial of 1929; WZ-100 100 h.p. five-cylinder radial of 1930; and Avia P-4 90 h.p. four-in-line of 1930. All these were built under supervision of W. Narkiewicz. Avia was also producing components for the Polish-built Wright Whirlwind, and various engine accessories. The last fully tested Avia pre-war engine was the Avia 3 60 h.p. four-in-line inverted.

London, N.9. J. B. CYNK.

FORTHCOMING EVENTS

Aug. 18. Swiss Aero Club: International Balloon Meeting, Bâle.
Aug. 18-25. Aeronautical Union of Jugoslavia: International Parachute Contest, Tivat-Boka, Kotorska.
Aug. 23-25. Sporting Flying Club: International Rally, Copenhagen.
Aug. 24-25. Puy Aero Club: International Rally, Le Puy.
Aug. 31. R.N.A.S. Lee-on-Solent, Hampshire: At Home.
Sept. 1-15. Anglo-American Conference, London and Folkestone.
Sept. 2-8. S.B.A.C. Show, Farnborough. (Public Days, 6th, 7th, 8th.)
Sept. 5. Helicopter Association of Great Britain: Annual Dinner, Dorchester Hotel.
Sept. 9-15. Battle of Britain Week.
Sept. 13. Royal Aeronautical Society: 45th Wilbur Wright Lecture: "Advanced Education and Academic Research in Aeronautics," by Dr. Clark B. Millikan, Hon. F.I.A.S., F.R.Ae.S.
Sept. 14-15. Popular Flying Association: Rally, Sywell.
Sept. 15. R.Ae.S. Garden Party, Wisley.
Sept. 16-20. Institute of Metals: 49th Annual Autumn Meeting.

THE INDUSTRY

High-density Seating

A NEW type of passenger seat announced by Aircraft Furnishing, Ltd., 41 Lonsdale Road, London, W.11, has been designed for "maximum comfort and facilities" under conditions of close pitching for so-called thrift-class travel, and also to meet normal tourist standards. Two features of its construction are the 15in rear-beam shin clearance, allowing forward relaxation; and tip-up seats such as are fitted in cinemas. The manufacturers state that tests with these chairs at 32in/34in pitching indicate that the latter feature may well become an essential for aircraft seats used at such close pitches.

Two versions of the new Aircraft Furnishing chair are at present being developed, one with hingeing and folding legs and the other with rigid legs transversely adjustable. The former type, produced with B.E.A. co-operation and in double chair form, is designed for forward and aft facing and loads of 9g. In addition to features already described it incorporates recline mechanism, folding tables and folding intermediate arm-rest. Both double and triple versions are interchangeable for the Viscount 700 and 800 series, and can be folded and stowed when freight space is required.

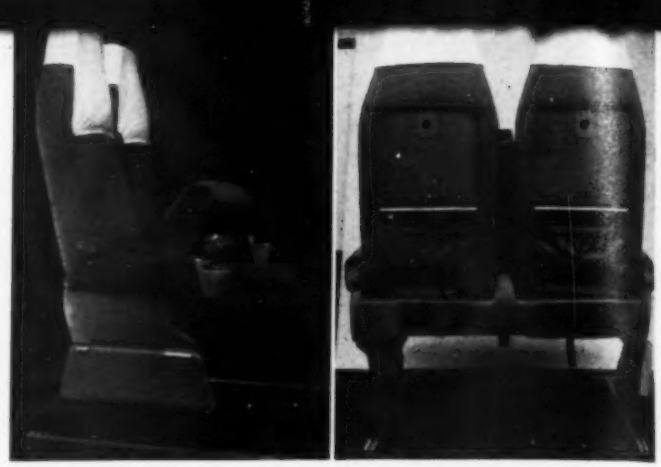
A more traditional type of chair, with rigid adjustable legs, has been developed by the company with B.O.A.C. co-operation as suitable for Britannias 102 and 312, DC-7C, Comet 4 and Boeing 707. Backs of both types fold forward when force is applied.

A. C. Wills

WE regret to record that Mr. A. C. Wills, for many years publicity officer for Rotol, Ltd., died in Cirencester Memorial Hospital on August 7 at the age of 41. He was a member of the Bristol tobacco family and in his work for Rotol became well-known in the aircraft industry; he travelled extensively both in this country and on the Continent. During the last war Mr. Wills lost a leg in France and he took a leading part in activities of the Gloucester and Cheltenham branch of B.L.E.S.M.A.

New Aircraft Steps

KNOWN as the Spurling Stairway, a new type of aircraft passenger steps has been designed by Spurling Motor Bodies, Ltd., Edgware Road, London, N.W.9. It is constructed in three sections—chassis, lower assembly and upper assembly—and the manufacturers point out that the structure (mechanically operated throughout) can be adjusted for different heights or "knocked down" for transportation, has full lighting equipment incorporated and is stable in winds up to 75 m.p.h. The height range is 6ft 3in at the midway platform to 10ft 7½in at the top one; step treads are 11½in deep and step risers 7½in. Two of the Spurling Stairways are already in use at London and Prestwick Airports.



Important features of the passenger seat developed by Aircraft Furnishing, Ltd., and described in the adjoining column are the tip-up seat (shown to the left, above) and generous 15in rear clearance.

G.E.C. Equipment Orders

AIRCRAFT catering equipment made by the General Electric Co., Ltd., is now used by 45 airlines operating 25 different types of aircraft. A year ago, the U.S.S.R. placed an order with G.E.C. and that country has recently ordered three complete aircraft sets, including galley equipment, passenger reading lights and warning signs (though the aircraft for which these are intended has not been specified). Now, following a sales tour of the U.S.A. by Mr. W. H. M. Butcher, new orders worth $28,000—including one from T.W.A., which already has 40 G.E.C. ovens in use in its aircraft—have been placed with the company.

Pressure-impulse Counter

A SIMPLE pressure-impulse counter which can be coupled into any circuit has been developed by the aviation division of the Dunlop Rubber Co., Ltd., Holbrook Lane, Foleshill, Coventry, Warwicks. It measures only 2⅞in × 1½in × 1½in and weighs approximately ½ lb. The company states that providing upper and lower critical pressures can be established, based on the pressure fluctuations normal to a system, counters can be provided to suit particular requirements.

IN BRIEF

Mr. N. L. G. Lingwood, distribution director of British Oxygen Gases, Ltd., has been re-elected president of the British Acetylene Association.

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Bakelite, Ltd., 12-18 Grosvenor Gardens, London, S.W.1, have issued a comprehensive list (up to July 1) of Bakelite laminated materials complying with Government, B.S.I. and S.B.A.C. specifications.

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Mr. E. Dacre Lucy has been appointed sales director of Technivision, Ltd., and he will also be responsible for the firm's sales promotion and publicity.

* * *

Oldham and Son, Ltd., the battery manufacturers, have announced a group net profit of £452,697 (before providing for taxation) for the past year, compared with £398,419 for 1955-56. This figure is included in the directors' report, published in advance of the annual general meeting, which is to be held at the company's head office in Denton, Manchester, on August 30 at 12 noon.

Mr. S. A. Gibbons, who has been appointed chief engineer of the Bendix connector division, part of the aircraft components group of Thorn Electrical Industries, Ltd. Prior to joining the Plessey Co., Ltd., in 1946, he was with the Ministry of Aircraft Production, where he was concerned with the development of wiring components and systems.

Mr. T. C. Cleveland, formerly export shipping manager for E. K. Cole, Ltd., has been appointed acting manager of the company's export department; and Mr. D. G. F. Farmer, formerly assistant to Mr. Cleveland, has been appointed acting export shipping manager.

* * *

A brochure published by the Air Engine Service Group, whose head office is at Blindley Heath, Lingfield, Surrey, describes and illustrates comprehensively the development and work of the group's three companies—Air Engine Services (U.S.-U.K., Ltd.), Air Engine Parts, Ltd., and Aviation Electro-Plating—in engine overhaul, the supply of spare parts, and the plating of components.

* * *

Roundhay Metal Finishers (Leeds), Ltd., have issued a brochure describing and illustrating their activities, which include cleaning and metal preparation, polishing and plating, painting, and the surface treatment of aluminium.

* * *

Neil James Dunn, aged 23, of Glasgow, who joined Kelvin and Hughes, Ltd., seven years ago, has been adjudged by the Institute of Electrical Engineers the best electrical engineering student for 1956 in the whole of Scotland.

* * *

Mr. Lawrence Dilger, B.Sc., has been appointed senior designer of the electronics division of the Microcell group, with responsibility for development of new electronic computers; and Dr. John Christie, D.Sc., Ph.D., is now senior mineralogist with the same company, directing the development of new forms of ceramic materials.

* * *

Mr. P. W. Howard, managing director of the British Tyre and Rubber Co., and chairman of the Research Association of British Rubber Manufacturers, has been elected President of the Association in succession to Lord Baillieu, chairman of the Dunlop Rubber Company. Mr. D. B. Collett, Dunlop director, succeeds Mr. Howard as the Association's chairman.

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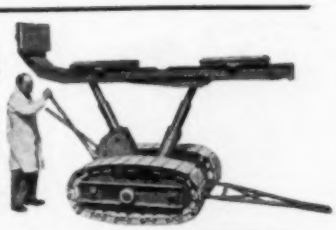

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APPLICATION No. 409/3, for an amendment to the terms of approval of the Vehicle Ferry Service which they are authorized to operate between Belfast (Newtownards) and Stranraer (Castle Kennedy) so as to permit until 31st December, 1957, the carriage without restriction of passengers not accompanying vehicles.

APPLICATION No. 56/2 for an amendment to the terms of approval of the Vehicle Ferry Service which they are authorized to operate between Southampton and Cherbourg so as to permit operation on the route Southampton and/or Hurn and/or Gatwick-Cherbourg.

APPLICATION No. 388/1 for an amendment to the terms of approval of the Vehicle Ferry Service which they are authorized to operate on the route Southampton and/or Lydd-Le Havre and/or Deauville, so as to permit operation on the route Southampton and/or Hurn and/or Gatwick and/or Lydd-Le-Havre and/or Deauville.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representation or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [6956

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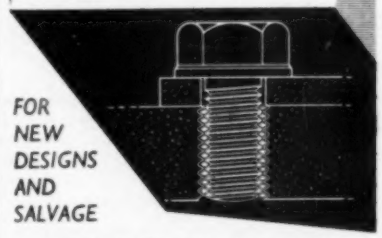

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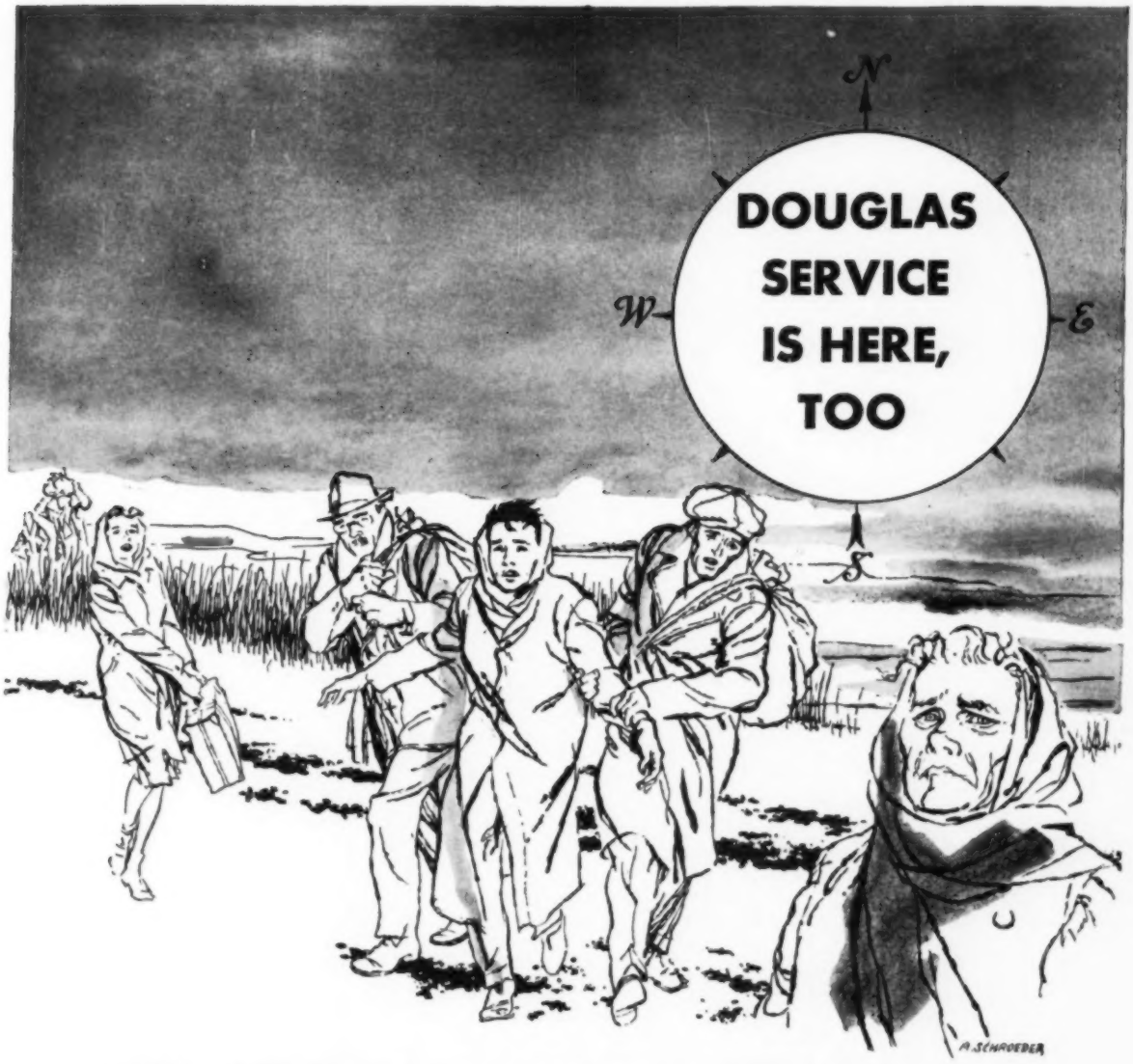

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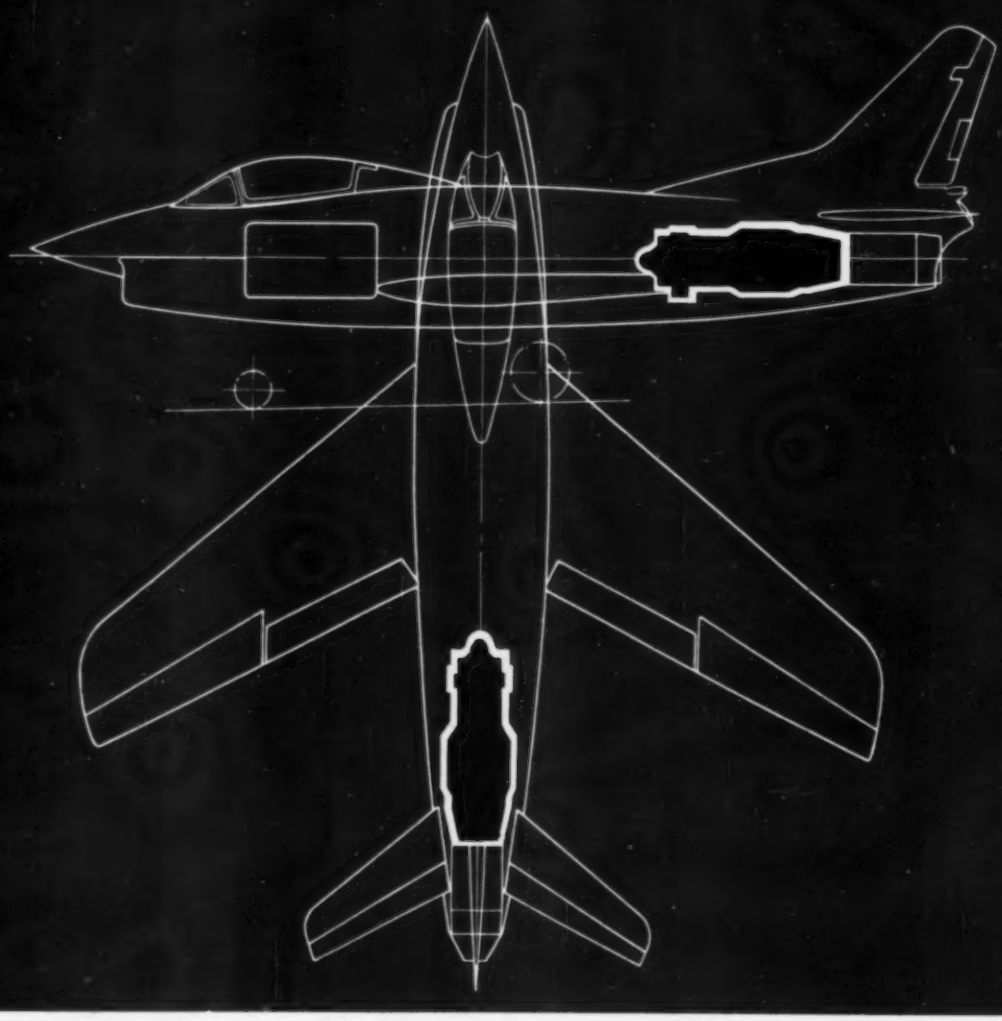

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